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VOL. 37, NO. 3 MARCH, 1948

Industrial Arts and Vocational Education

THE SHOP TEACHERS' PROFESSIONAL MAGAZINE

THE BRUCE PUBLISHING COMPANY | CENTRAL OFFICE: 105 SO. LA SALLE ST., CHICAGO 3, ILL.
540 NO. MILWAUKEE ST., MILWAUKEE 1, WIS. | EASTERN OFFICE: 330 WEST 42ND ST., NEW YORK 18, N.Y.

The 1948 School Shop Annual

This issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION contains many items that are helpful to those engaged in planning new or redesigning old school shops. To those engaged in, or contemplating, this work, the first two articles may offer quick solutions to troublesome problems. Eastman's "Check List for School-Shop Planning" also deserves scrutiny. It may help to avoid future troubles.

The article on Boys Town new shop developments presents shop layouts that contain numerous suggestions. Then there are a number of shop plans, which, although not new, have been found to answer very well in the schools for which they were originally designed.

Then there are eight outlines of instruction which present materials the reader may want to adopt wholly or in part; two articles on personnel organization, and four which are roughly classified as miscellaneous. Two of these, the "Evaluative Criteria for Vocational-Industrial Schools and Classes," and a "General-Shop Progress Chart," are especially recommended to School Shop Annual readers.

There also are some tests which may be found helpful. Lack of space made it impossible to insert more than just a few problems and projects into this issue of the magazine.

This Month's Cover

Our cover picture this month presents the woodworking end of a composite general shop such as is described in H. H. London's "Laying Out the One-Teacher Industial-Arts Department," on pages 81–82.

Coming Conventions

Feb. 21–26. American Association of School Administrators, at Atlantic City, N. J. Secretary, Mr. Worth McClure.

Mar. 18–20. New Jersey Vocational and Arts Association, at Asbury Park, N. J. Headquarters, Berkeley-Carteret Hotel. Secretary, John J. Berilla, 549 Corliss Ave., Phillipsburg, N. J.

Mar. 29–Apr. 1. National Vocational Guidance Association, at Chicago, Ill. Headquarters, Stevens Hotel. Secretary, Christine Melcher, 82 Beaver St. New York City.

Mar. 29–Apr. 1. New York State Vocational Association, at Buffalo, N. Y. Headquarters, Statler Hotel. Secretary, Dr. Malcolm Galbreath, Morrisville Technical Institute, Morrisville, N. Y.

Apr. 7–10. Mid-West Physical Education Association, at Indianapolis, Ind. Headquarters, Claypool Hotel. Secretary, Anne Finlayson, Senior High School, Kalamazoo, Mich.

Apr. 8–10. Southeastern Arts Association, at Columbia, S. C. Headquarters, Columbia Hotel. Secretary, Miss Ruth Harris, 111 W. 11th St., Johnson City, Tenn.

Apr. 8–10. Texas Vocational Teachers Association, at Houston, Tex. Headquarters, Rice Hotel. Secretary, Cecil Brice, Drawer BB, Capital Sta., Houston, Tex.

THE NATIONAL SOCIETY FOR CRIPPLED CHILDREN AND ADULTS, INC.
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Entered January 2, 1914, as Second-Class Mail Matter at Milwaukee, Wis., under Act of March 3, 1879. Copyright, 1948, by the Bruce Publishing Co. Title registered as Trade Mark in U. S. Patent Office, November 25, 1930. Published monthly except during July and August.

Subscription Information. — Subscription price in the United States, Canada, and countries of the Pan-American Union, $3.00 per year, payable in advance. Postage, foreign countries, 50 cents. Copies not over three months old, 35 cents; more than three months, 50 cents.

Discontinuance. — Notice of discontinuance of subscription must reach the Publication Office in Milwaukee, at least fifteen days before date of expiration. Notices of changes of address should invariably include the old as well as the new address. Complaints of nonreceipt of subscribers' copies cannot be honored unless made within fifteen days after date of issue.

Editorial Contributions. — The Editor invites contributions bearing upon Industrial Arts, Vocational Education, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.

Articles Indexed. — The articles contained in the Magazine are regularly indexed in "The Readers' Guide to Periodical Literature," and "Education Index."

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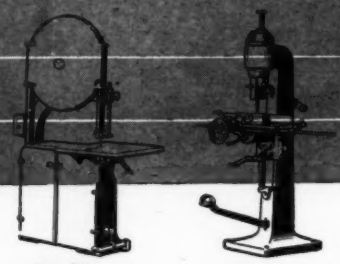
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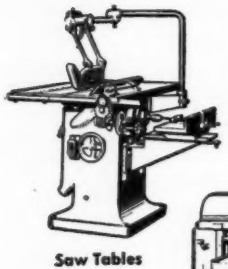
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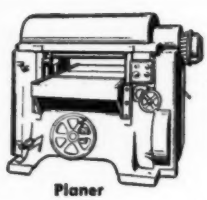
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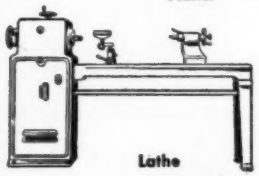
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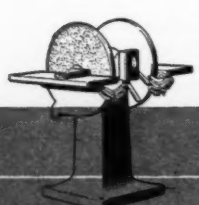
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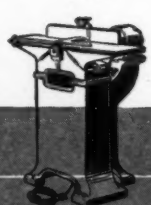
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MARCH . . . 1948

Laying Out The One-Teacher Industrial-Arts Department

H. H. LONDON
Professor of Industrial Education
University of Missouri
Columbia, Mo.

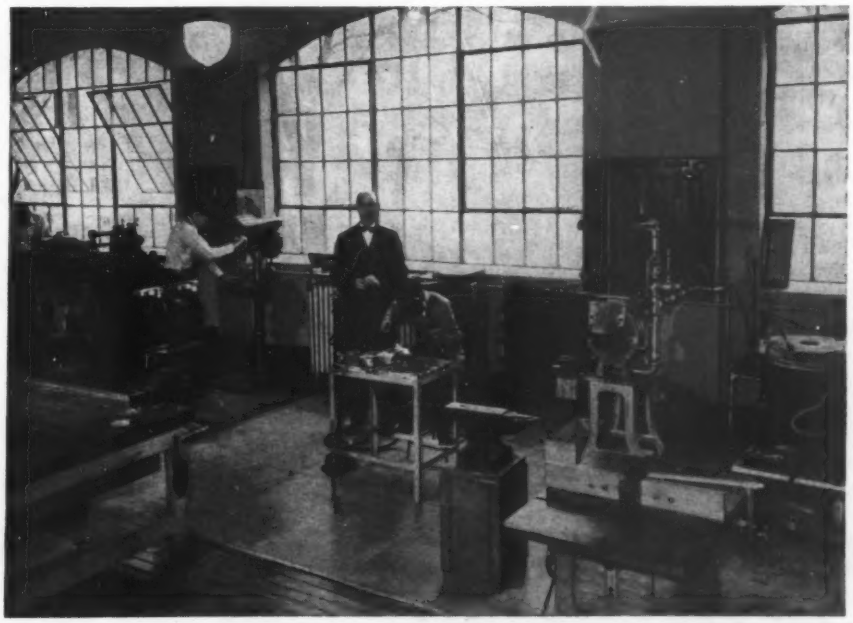
The major problem in laying out a new industrial-arts department, or in reorganizing an old one, especially in the small school, is to get the most usable space, the most suitable equipment, and the very best program possible with the means available. To this end, the department should be carefully planned in detail before construction begins and before equipment is purchased. If a school does not have someone on its staff who is trained in school shop planning, the superintendent will do well to consult a specialist in the State Department of Education or in a college or university which prepares teachers for this work. These agencies are prepared and are anxious to aid in the planning of better school shops.

School shops cost money, and a community should realize that it is futile to attempt to establish or reorganize one without sufficient funds to provide reasonably adequate space and equipment and, of course, a competent teacher. If new housing is to be provided, and funds are limited, it may be advisable to construct a factory-type building, separate from or adjacent to the regular high school. In any event, the shop should be constructed, equipped, and arranged so as to insure: (1) instructional convenience, (2) safe and economical operation, (3) ease of administration, and (4) maximum educational values to the student. If the school's enrollment is expanding rapidly and it is likely that the shop program will need to be enlarged from time to time, then the original layout should be planned with this in view.*

One of the most important decisions to be made in laying out an industrial-arts department is to determine the type of shop or shop organization to be used. Unlike trade school shops, the activities to be included in the industrial-arts shop should not be determined by local industry, except to a limited extent. On the contrary, if industrial arts is to interpret industry to youth, to provide exploratory experiences and consumer values, and to develop basic skills and understandings in the care and use of common tools and materials, then its content obviously must transcend local industry and include a wide variety of fundamental industrial experiences common to the country as a whole.

*For a fuller discussion of architectural details, location, size and shape of shops, auxiliary and service features, and the selection and arrangement of equipment for small schools, see Chap. IV of the "Missouri Industrial Arts Handbook," Practical Arts Bulletin 7B, 1945 Revision, State Department of Education, Jefferson City, Mo.

For the school with a one-teacher department, the choice of the type of school shop is simple. What this school should have is a *composite general shop*, planned and equipped to provide instruction in the basic elements of hot and cold metal work, applied electricity, bench and machine woodwork, and the more common crafts such as leathercraft, plastics, and art metal, with drawing and planning as an integral part of the shopwork. If space and funds permit, some work in printing and automotives may be added. Although a bit more difficult to organize and teach, this type of shop offers about the only means through which the small school can provide a rich and well-balanced program of industrial arts. There is no such thing as a balanced diet consisting wholly of potatoes! Neither is it possible to offer a balanced program of industrial arts in a single shop confined to woodwork, metal-



Metalworking end of composite shop

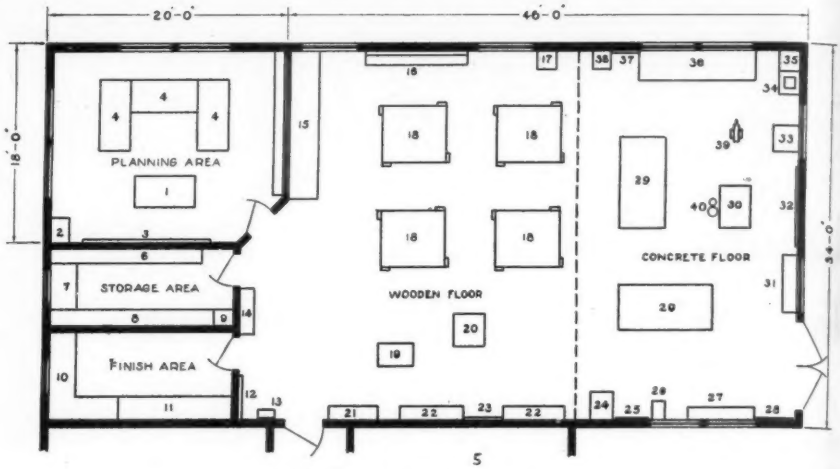
work, or any other one activity. The unit-type shop simply is out of the question for the small school.

The layout shown herewith pictures a proposed composite general shop for the one-teacher industrial-arts department. The equipment provided is as follows:

Arranged and equipped as planned, this shop would take care of classes of from 24 to 30 students with approximately 60 to 65 square feet of floor space per student, exclusive of the auxiliary rooms. Following a one-year course in general shop, courses in metalwork, electricity, and woodwork could be offered to classes of from 12 to 16 students, thus providing more advanced study for those who elect to continue in industrial arts. By providing stools and drawing equipment, courses in drawing could also be given in the shop.

Although the composite general shop includes equipment for several different types of industrial work, it is not an expensive shop to set up and operate in comparison with the unit-type shop. The unit-type shop, where all of the experiences are "stacked up vertically" in one area, soon involves advanced equipment and more elaborate and expensive materials if students are to be kept profitably engaged for sustained periods of time. On the other hand, in the composite general shop, where the experiences are "spread out horizontally," the work can be confined to the more elementary processes, at least in the beginning courses, thus minimizing the necessity of getting into expensive equipment and materials. Here, a wide assortment of hand tools are undoubtedly more essential than expensive machine equipment, and in setting up the shop preference should be given to hand tools and bench equipment.

Some school shop men, steeped in the tradition of the unit shop, object to the composite general shop on the ground that it is impossible to operate satisfactorily. And it is, for the fellow who insists on carrying over his unit-shop techniques and procedures to the composite general shop. A composite general shop is not four or five shops in one, but rather a shop in which the subject matter experiences have been selected from different phases of industry, on the basis of student interest, relative importance, and suitability for school shop purposes, and organized into a unified program. Well-organized instructional materials are, of course, necessary in the operation of this type of shop. Likewise, a student personnel organization is essential, whereby many of the routine duties of operating the shop may be assigned to the students themselves, thus developing managerial ability and freeing the teacher to look after matters of instruction. Finally, the most important thing is to have a teacher who has been broadly trained, who is willing to tackle new experiences, and who knows how to give individual instruction and to manage people, materials, and equipment.



COMPOSITE GENERAL SHOP

1. Teacher's desk; 2. steel filing cabinet for instructional materials; 3. blackboard and projection screen; 4. flat top tables; 5. book and magazine shelves; 6. metal rack; 7. short stock storage bins; 8. lumber rack; 9. supply cabinet with lock doors and drawers; 10. finish bench with shelves overhead; 11. finish cabinet with bins underneath; 12. bar clamp rack; 13. sink and drinking fountain with bulletin board overhead; 14. exhibit cabinet with glass shelves and doors; 15. electrical workbench with steel lockers underneath; 16. tool panel with cabinet underneath; 17. jig saw; 18. woodworking benches with steel cabinets underneath; 19. jointer, 6 to 8 in.; 20. universal table saw, 10 in. or larger; 21. steel top glue table; 22. motor-in-head wood lathes; 23. panel for turning and spinning tools; 24. band saw, 16 in. or larger; 25. tool panel for drills, gauges, etc.; 26. pedestal-type drill press, 16 in. or larger; 27. machine lathe, 10 in. with quick change gear; 28. panel for lathe tools, chucks, etc.; 29. metalworking benches, 3 ft. 8 in. by 7 ft. 6 in., one with stake plate and four 4½-in. machinist's vises, one with soldering furnace, buffer, and three machinist's vises; 30. steel welding bench with firebrick top; 31. metal lathe, 16 in. with quick change gear; 32. tool panel for metalworking tools; 33. coal or gas forge; 34. flue, 6-brick or larger; 35. coal box; 36. foundry bench, 3 by 10 ft. with sandbox underneath (flasks and mold boards to be made in shop. Type metal to be melted in soldering furnace); 37. panel for foundry tools; 38. jig saw; 39. anvil; 40. acetylene and oxygen tanks with pressure regulators, hose, etc.

Forming pipes on a boiler-plate roller at the Hobart Trade School, Troy, Ohio

— Courtesy, Hobart Brothers Co., Troy, Ohio

A Practical Approach to Shop and Laboratory Planning

EMANUEL E. ERICSON
Professor of Industrial Education
University of California
Santa Barbara, Calif.

Complaints are often expressed by teachers that architects and planning committees do not pay attention to details needed for laboratory and shop teaching when buildings are planned and directed. While this may be basically true in some instances, it is also true that if these same teachers would be as articulate during the period of planning as they are after the buildings are completed, some practical results would probably be obtained in most instances. In the majority of cases where the teacher feels after the building has been completed that he was not consulted or that his advice was not taken, it is probably true that he was not diligent enough in discovering or creating opportunities to show to the planning authorities the particular details that would in his case pertain to better instruction and more efficiency in the teaching of his work. Teachers and supervisors are often prone to stay in the background until the practical planning has proceeded too far for serious alteration to be considered, or if they are asked for advice, the information that they would give would be so general that it would be of little value to the architect who is doing the planning.

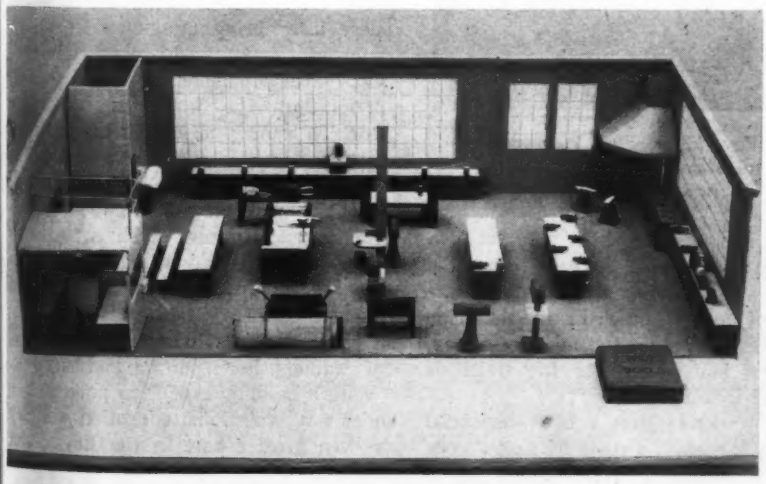
Scale Models Give Definite Results

In the industrial-arts teacher education program at Santa Barbara College one of the courses involves specific shop and laboratory planning with detailed study of the various major aspects pertaining to the physical facilities of a modern shop. One of the difficulties encountered in planning, both by inexperienced teachers and by those who have had a good deal of experience, is the failure of visualizing correctly the amount of space that would be required by the various pieces of equipment and the necessary areas for carrying out the work upon that equipment. In order that correct plans may be made of all of the aspects of shop and laboratories, the students are required to work out scale models as illustrated in the accompanying illustrations for a variety of shop situations in industrial arts. In the making of these models, all major pieces of equipment and all of the stationary tools are worked out to exact scale in keeping with the proportion of the room itself, including workbenches, seating space for students, demonstration desk, office, stock room, tool cabinets, motor-driven machinery, and hand-operated devices, racks for materials, wash basins, racks for discards, and special study tables. The room itself is made to scale, including the height of walls built from thin plywood or heavy cardboard with windows and doors shown on the interior of the structure. The walls are so made that they can all be laid out flat in order to give a better view to the floor area.

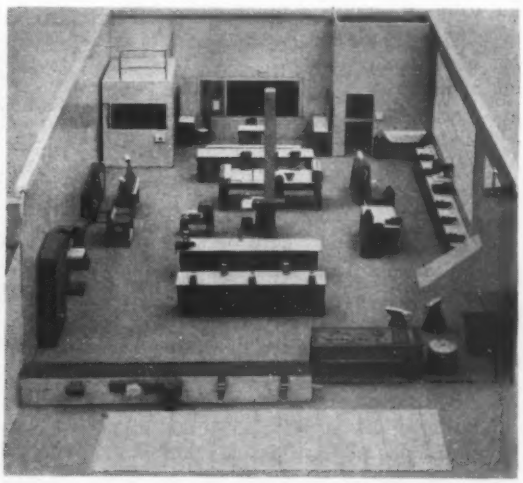
Use of Check List Encouraged

From extensive analyses of all items that should be taken into consideration in connection with shop and laboratory planning, students will work up a combined list for the class which is retained by the students for future use in connection with practical situations in their later professional work. Lists of this type have been made out containing from 60 to 75 different items for consideration when planning shops and shop buildings. The following items are typical ones appearing in such a list:

1. Subjects to be taught
2. Funds available
3. Location of shop with reference to other buildings or other rooms
4. Outside entrance best for deliveries
5. Provision for browsing table, or reference table



Side view. Scale model of general metal shop with equipment made from wood, plastics, and metal. Painted in modern color scheme. Front wall laid flat to show interior.
Submitted by E. E. Ericson



End view, with end wall laid flat to show interior. Scale model of general metal shop.
Model made by William R. Hahn and Jack A. Phinny, students

6. Acoustical treatment of building
7. Location of office or desk space
8. Seating area for students
9. Space for storing projects under construction and after completion
10. Provisions for showing exhibits
11. Place for painting and finishing, running water, and facilities for washing
12. Availability of compressed air
13. Blinds and window shades
14. Suitable color schemes for walls, floor, and equipment
15. Bulletin boards for announcements
16. Master switch for machines
17. Place or area for planning and designing

The foregoing list can, of course, be expanded greatly. The point here is that such a check list should be in possession of every teacher or supervisor who may have the opportunity of participating in the planning and erection of new school shops or laboratories.

If the industrial-arts teacher or supervisor or any other teacher using laboratories and equipment would go to the trouble of planning to scale and executing a model of the completed room and the facilities which he considers justifiable for efficient teaching and then make a complete model such as is shown, he will usually have very little difficulty in impressing his administrators and those who are planning school buildings with the fact that he himself has made a sufficient study of the needs in connection with his work to be worthy of recognition. If such a model is produced neatly and painted in the colors desired by the instructor, a large part of the problem for adequate teaching facilities will have been won. Teachers who are not sufficiently interested to invest time and effort in such planning, should not use up their time to express disappointment and complaints after someone else has planned and completed their shops.

Vocational Education in Boys Town

HENRY V. STRAKA
Boys Town, Neb.

The Rt. Rev. Msgr. Edward J. Flanagan, better known throughout the world as Father Flanagan of Boys Town, has always been an ardent advocate of vocational education. From the very beginning of Boys Town, 30 years ago, vocational training has played an important part in the Boys Town program, and at the present time, with an extensive building expansion program under way, vocational facilities will be greatly strengthened.

Father Flanagan has long recognized the value of manual skills in the training of boys. Boys Town, a home and school for homeless, abandoned, neglected, and underprivileged boys of every race, color, and creed, has been home to more than 5500 boys who received there the first break they ever had.

They are not bad boys, as Father Flanagan is quick to point out. They are bewildered children who have been deprived of the normal love, care, and training which is the heritage of every child in a natural home. Because of such unsatisfactory backgrounds, often times they lack confidence. In many cases their schoolwork has been neglected.

The importance of vocational education in the training of such boys is particularly great. Sociologists recognize the fact that a boy who has acquired skill in the use of his hands develops greater co-ordination of mind and body, and has a better balanced personality.

Rt. Rev. Msgr. E. J. Flanagan, founder and director of Father Flanagan's Boys Town

There is something about being able to operate a lathe, for instance, or being able to build a bookcase or a cabinet, or make a piece of pottery, which instills the pride of accomplishment in the mind of a boy, and gives him a zest for life which is otherwise lacking.

"Trade training has a most beneficial effect on the boy," Father Flanagan says. "There is something very exhilarating to a boy in being able to do something with his hands — making something with tools — creating something useful. This is character building, and oftentimes the solution of a boy's behavior problem. I note that most of our behavior problems here at Boys Town are with boys who have not been taught much, who can do nothing with their hands, whose minds are, therefore, not easily attracted to useful things, and who have too much time on their idle minds."

There is another important reason why Father Flanagan stresses vocational training. Boys Town is not merely a home and school where boys remain until they are 18, or until they complete their high school education. It is a preparation for life, and the Boys Town program is designed to prepare its citizens for a useful life.

The percentage of boys in the United States who continue their education in college after being graduated from high school is comparatively small. Most of them, after completing high school, go out into the world to earn their living. To train them for this lifetime task, a number of trade courses have been taught at Boys Town on a four-year basis. Among these are machine shop, woodworking, ceramics, and printing. Each is taught by a competent instructor who knows his own trade thoroughly, and who is also qualified as a teacher. In addition, vocational training has been offered in agriculture, laundry, dry cleaning, shoe repairing, and barbering.

With a building expansion program now under way, vocational education will play an even greater part in the Boys Town program.

The trades school, when completed, will be one of the most modern in design and equipment in the nation. It will be the finest school of its kind in Nebraska, and

will go far beyond anything now being offered in the state. Father Flanagan, along with Boys Town school officials and officials of the Nebraska Department of Vocational Education, have worked out a trade school program especially for Boys Town.

Trades that will be taught in the new trades program include machine shop, woodcraft, ceramics, printing, auto mechanics and auto electric, baking, sheet metal, shoe making, tailoring, electricity and radio, barbering, and vocational agriculture.

The course in auto mechanics will include all phases of internal combustion engines, automotive electricity, and some work in aviation engines. The machine shop will include work in arc and gas welding, and will stress the maintenance as well as the operation of drill and punch presses, lathes, milling machines, planers, shapers, and all the operations of a well-equipped machine shop.

The course in electricity will teach elementary electricity, electric maintenance and appliance service, domestic refrigeration, and elementary radio and radio servicing.

The expanded woodshop will include carpentry, cabinetmaking, and patternmaking. The printing trade will include composition, press work on both hand-fed and automatic presses, hand and machine typesetting, and binding. A course in journalism will be available for printing students.

The Boys Town ceramic shop, which is the only complete course taught in this subject in a high school in the United States, will include ceramic design and decoration, ceramic chemistry, mold making, glazing, firing, hand modeling, and advanced work in enamel on metal and decoration on glass.

The new bakery will teach both dough baking and pastry. Vocational agriculture, now taught on a one-year basis, will be expanded into a full four-year course.

Since the vocational training program is part of the Boys Town high school, students electing vocational courses must also take certain required studies in the academic department, including English, science, mathematics, United States history, and civics. Half of the school day will be spent on academic studies, the other half in the trade school shops.

Trades which the boys take will be determined by prehigh school training. A required course in general shop will be offered to seventh- and eighth-grade boys. In these general courses, the boy will receive three weeks of training in each of the trades. When he comes into high school he will be given an aptitude test which, together with his record in general shop, will help to determine which course he should follow in the trade school.

Father Flanagan's program is founded on the theory that the good citizen is the useful citizen. While providing the environment and the guidance for the purpose of building character in the boy, the Boys Town program also aims to teach him in a practical manner so that when he goes out from Boys Town he will have confidence in his ability to stand on his own feet. In this way Boys Town is making a genuine contribution to a better America, by building better citizens, not only in character but in practical training.

The new vocational training program will continue, as it has been in the past, as an integral part of the high school program. The boys who elect to follow trade courses will participate in the community life of Boys Town, and in the scholastic and extracurricular activities of the high school in the same degree as the other students.

Membership in all interscholastic and intramural athletic teams, the Boys Town choir, the Boys Town band, and all other activities will be open to vocational students on an equal basis with boys who pursue a college preparatory course.

The man who will direct the new vocational training program at Boys Town is Peter F. Mulready, who has been on the Boys Town faculty for the past five years. He is a graduate of the University of North Dakota, where he received his degree in education, majoring in industrial arts. His 15 years of teaching experience include nine years as superintendent and six years as shop instructor in North Dakota and at Boys Town. He also served for three years as NYA shop supervisor for the eastern district of North Dakota, and two years with the engineering division of the North Dakota department of agriculture.

Mr. Mulready spent several months this spring traveling over nine states, principally in the industrial Midwest and East, where he visited the outstanding trades schools.

One of the things which impressed Mr. Mulready on his tour was the close cooperation among school officials and union and industrial leaders. As a result of his investigations, the Boys Town program will be based on recommendations received by the various unions which furnish industry with skilled workers, and by those of the industrialists who are in a position to advise as to the kind of training they desire in the workers they wish to employ.

As a result, when the graduate finishes his vocational training study, he will be equipped both in theory and experience to take up in industry where he left off at Boys Town. Although the trade school courses will be regular four-year courses, the fact that half of the school day is devoted to academic subjects reduces the training he gets in the shops to two years, and in most instances, it will be necessary for the graduate to spend an additional two years as an apprentice before qualifying as a journeyman.

The reality which is Boys Town today began more than 30 years ago as the idea of a young priest, an assistant pastor in one of the Omaha parishes. Ordained to the priesthood of the Catholic Church in 1912, Father Flanagan was first assigned as an assistant pastor at O'Neil, Neb. The following year he was transferred to Omaha as an assistant at St. Patrick's parish.

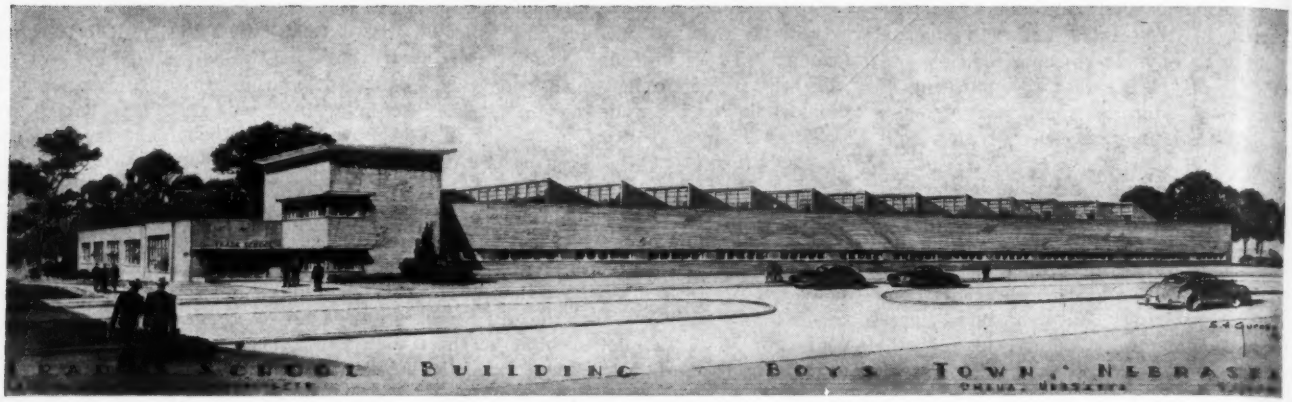
Several years of drought with resultant crop failures in the Nebraska wheat fields had brought an influx of jobless men into Omaha, and Father Flanagan, with a desire to do something for these unfortunates, established his Workingman's Hotel. Here the doors were always open to any man in need of a hot meal or a bed for the night.

Father Flanagan hoped to rehabilitate these men, and secure work for them, but to his surprise, many of them did not want work. They wanted a handout and a place to sleep. Beyond that they seemed to have no ambition.

In talking with the men who passed through his Workingman's Hotel — gamblers, dope addicts, drunkards, along with the jobless and the drifters on the tide of humanity — Father Flanagan found one recurring, significant fact. In their youth these men had been homeless, neglected, and underprivileged. The thought occurred to the young priest that while he was making some progress in rehabilitating these men, he should quit trying to straighten out the gnarled oaks, and go after the young saplings.

If he could take homeless boys, and give them a good home, a good education, and the love and care which is every boy's heritage, he could build them into upright citizens who would never need to depend upon a workingman's hotel for a meal or a bed. With this thought, Father Flanagan approached his superior, the Bishop of Omaha, and asked, and received permission, to open a home for homeless and abandoned boys.

With fresh enthusiasm, but with no

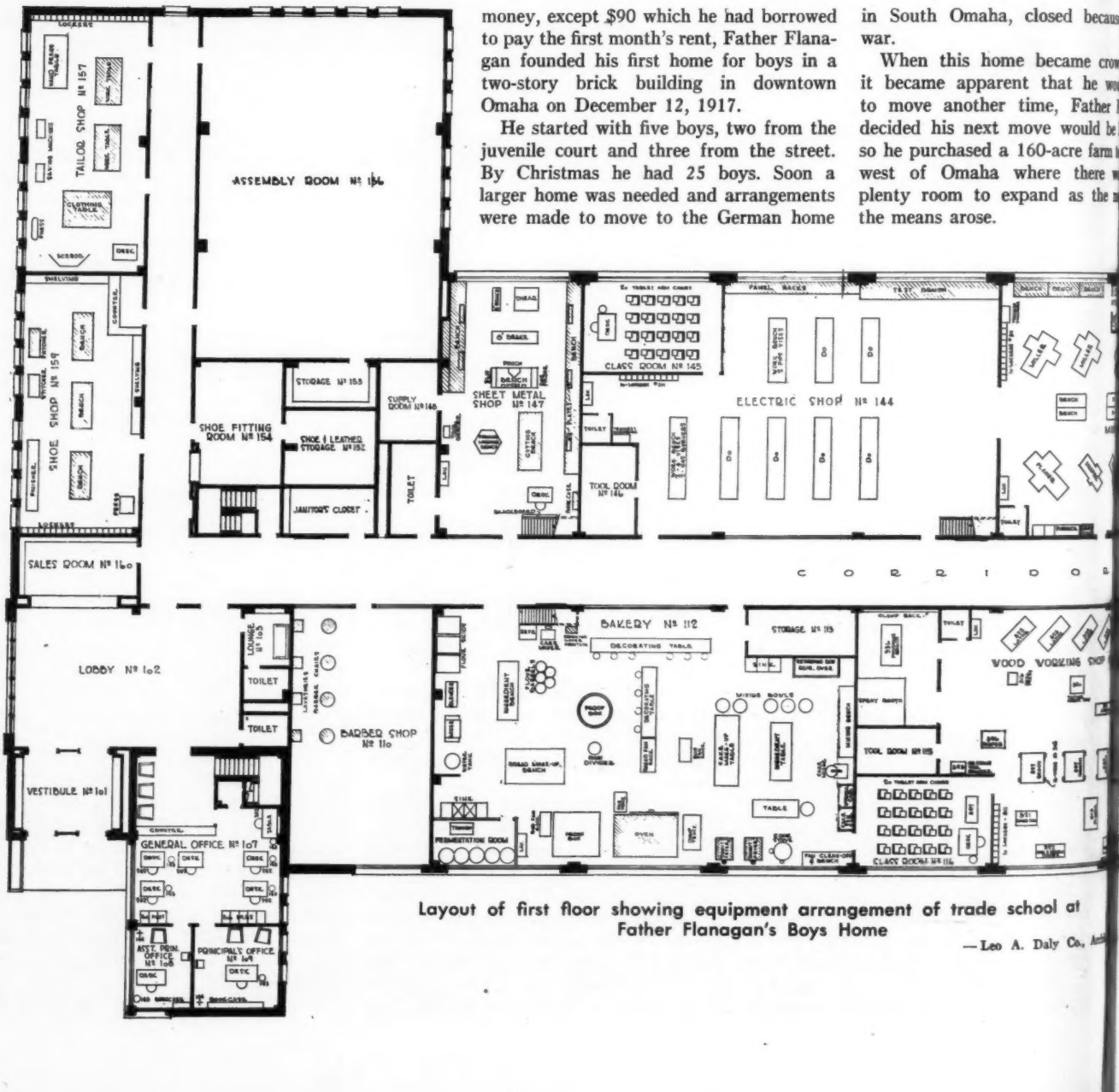


Trade school building, Boys Town, Neb.

money, except $90 which he had borrowed to pay the first month's rent, Father Flanagan founded his first home for boys in a two-story brick building in downtown Omaha on December 12, 1917.

He started with five boys, two from the juvenile court and three from the street. By Christmas he had 25 boys. Soon a larger home was needed and arrangements were made to move to the German home in South Omaha, closed because war.

When this home became crow it became apparent that he wo to move another time, Father decided his next move would be so he purchased a 160-acre farm west of Omaha where there w plenty room to expand as the n the means arose.



Layout of first floor showing equipment arrangement of trade school at Father Flanagan's Boys Home

—Leo A. Daly Co., Arch

Father Flanagan and his boys lived, ate, and slept in barracks-type shelters when they first moved to Boys Town. Omaha businessmen who recognized the nature and scope of the work being done raised funds for the first permanent building, a four-story structure which today houses the school, library, store, and student bank.

There have been additions since. These include four three-story apartment buildings, a trades building, post office, steam laundry, garage, stadium, dining hall, farm buildings, gymnasium, administration building, infirmary, chapel, and rectory.

An extensive building expansion program is now under way which, when completed, will double the capacity of Boys Town. In addition to the new vocational school building, a modern high school with facilities for 500 students is under construction. Other buildings are a new administration and welfare building, a new dining hall, 25 new cottages with facilities for 20 boys each, a new stadium and field house, and a reception center to serve the thousands of visitors who annually come to Boys Town.

Present facilities will be used by grade school boys, and the entrance age, now 12 years, will be lowered to six or seven years, and the first four grades of the elementary school will be added to the curriculum.

Father Flanagan's ability to succeed with boys where others have failed is due in no small measure to the confidence he instills in his boys. Many of the homeless and underprivileged boys who come to Boys Town have lost confidence in themselves. Father Flanagan believes self-confidence and self-esteem are necessary if a boy is to become a useful, well-adjusted citizen, and his entire program is designed to help the boy by training him to help himself.

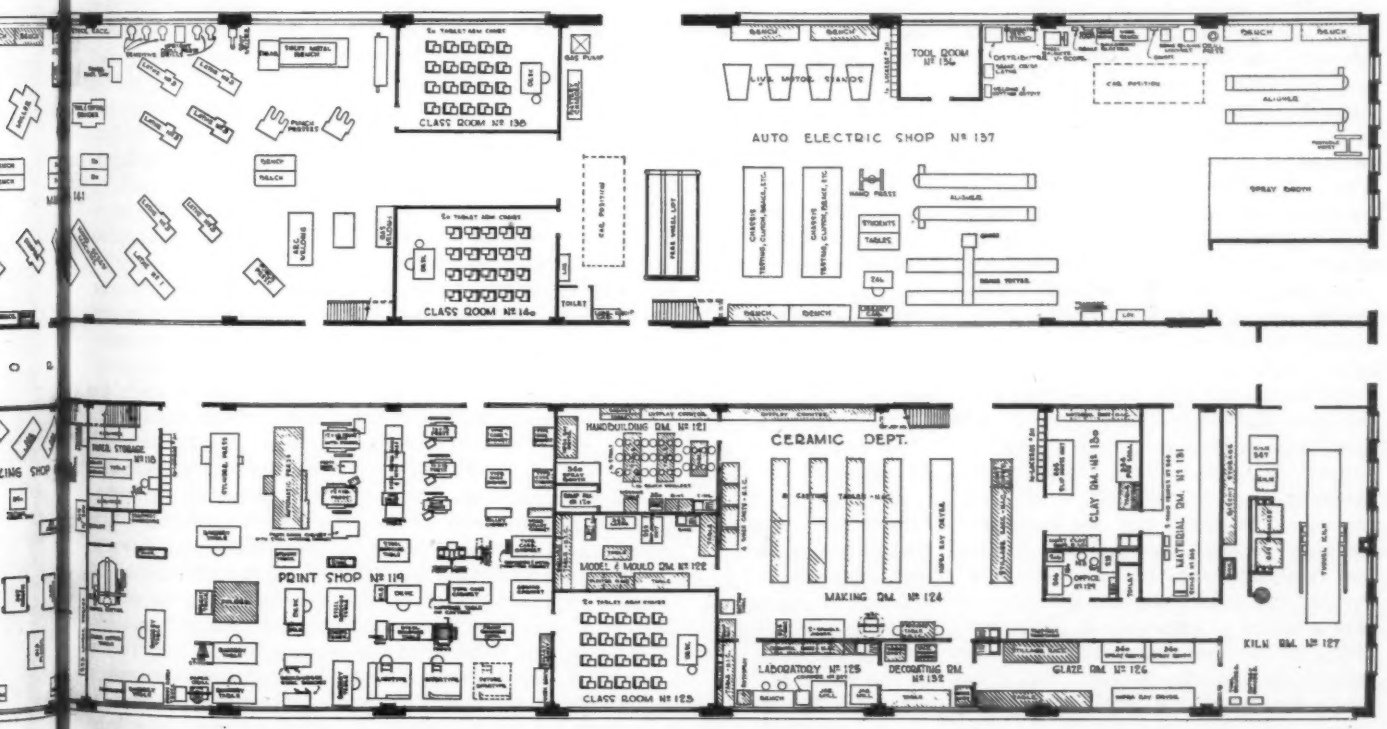
Since Boys Town is a home, as well as a school, it is necessary to provide for afterschool activities for the boys. Wholesome recreation is available for all boys. Facilities for tennis, softball, handball, swimming, archery, basketball, touch football, baseball, track, boxing, and other sports are available for intramural games. Every boy is encouraged to participate in one or more sports, because Boys Town recognizes the need for a healthy body to house a healthy mind. Hobby activities such as model airplane building, stamp collecting, leather and wood craft, scrapbooks, and Scouting, are encouraged.

Athletics play an important part in the Boys Town program. Father Flanagan, who himself was an athlete in his younger days, has often said that athletics are a sermon in themselves. The Boys Town high school football team has appeared from coast to coast. In addition to playing a number of the strongest high school teams in Nebraska and Iowa, each year two or three intersectional games with strong opponents are scheduled. The team is undefeated in Nebraska competition during the past three years, and was costate champion the past two years. Other interscholastic sports include basketball, baseball, track, swimming, boxing, and tennis.

Nor are cultural activities overlooked. The Boys Town choir is nationally famous, having been heard many times on coast-to-coast radio broadcasts, and making personal appearances throughout the midwestern states. Last year the choir made an extensive nine-week tour of 45 midwestern and eastern cities, presenting concerts in Carnegie Hall in New York City, Constitution Hall in Washington, D. C., Symphony Hall in Boston, and scores of other famous music halls.

The excellent Boys Town band and orchestra are well known throughout the midwest, having appeared in cities as far distant as Chicago. A former Viennese concert pianist gives piano instructions to more than a hundred boys each year.

In addition to their schoolwork, athletics, cultural activities, and recreation, each boy is required to do some work each day, to instill a recognition of the inherent dignity of labor. These tasks, assigned to each boy on the basis of age



and ability, may include work in the various buildings, on the lawn, on the farm, in the dairy, or the gardens.

The entire Boys Town program is well developed and closely knit, designed to provide love, care, education, and training to the homeless boys who are citizens of Boys Town, and to enable them, when they leave Boys Town, to take their rightful places in the world, a credit to themselves, to their community and to their country.

Boys Town is a monument to the wisdom and foresight of a man who loves boys. The more than 5500 boys who have called Boys Town their home are a tribute to Father Flanagan, who 30 years ago expressed his belief that "there is no such thing as a bad boy," and who in 30 years has found no reason to change his belief. Facilities, therefore, are being enlarged.

Methods of Teaching Occupational Subjects

C. A. FELKER
Department of Vocational Education
Toledo, Ohio

The shop instructor has many problems confronting him as he performs his daily tasks. A few typical ones are as follows: obtain jobs with training value; obtain jobs that can be performed with the available equipment, tools, and supplies; teach students how to perform these jobs; supervise students on the job; keep scrap to a minimum; teach correct use of tools; teach safe work practices; train tool crib attendants; maintain a shop progress record; teach the best work techniques with the tools and equipment available; train shop foremen; and inspect students' work. This is not a complete list, but it does serve to emphasize the necessity for careful planning, organizing, managing, and using accepted shop teaching techniques.

For the sake of brevity, we wish to confine subsequent discussion to accepted shop teaching techniques. These techniques are by no means new. They have been hammered out on the anvil of experience over the years. Essentially, they differ little from those used today by a mathematics instructor. As far as methods are concerned, the techniques used to teach a class how to extract the square root are just about the same as those used to teach a class how to straight turn on an engine lathe. Perhaps, we might say the difference is only a matter of emphasis. In the presentation of the shop lesson, the instructor tells, shows, and asks questions, and in the square root lesson, the instructor also tells, shows, and asks questions. In the shop lesson, the students are required to straight turn, and the instructor tests their performance. In the square root lesson, the students are required to solve a number of square root problems, and the instructor tests, or checks, their work. The difference lies in the technique of asking leading or suggestive questions in the shop lesson.

Of course, both use a lesson plan. These plans differ only in their physical make-up. Both assign a task to the students. The tools or devices used to carry out this part of the lesson again differ only in their physical make-up.

From the foregoing, it appears that the jobs of teaching square root and straight turning are the same. Again, let us say that, essentially, they are the same. True, there is a difference in the questioning technique already mentioned, but there is also a difference in responsibility. We readily agree that both have the responsibility to teach to the best of their abilities, but what might happen if the shop instructor does not get his lesson across? Not only could the work be spoiled, but the student could be injured, perhaps, permanently. This means that the shop instructor must teach as part of the lesson, work precautions, safety precautions, and information points as a part of the lesson. If he fails to put these items across in the lesson and a student suffers the loss of a finger, a hand, or even an arm, this mistake cannot be erased with the eraser on a pencil. The shop instructor cannot emphasize and stress these precautions too much. He cannot afford to.

In putting over this lesson on straight turning, the shop instructor follows the 4-step lesson, using the proper techniques and devices. One of the most important and effective devices that he has at his disposal is the question. The effective use of questions in the shop lesson is a powerful tool in the hands of the shop instructor, and he should become proficient in their use.

The Technique of Questioning

When the shop instructor is teaching a shop lesson, he should make use of the following types of questions:

1. *Direct questions*
2. *Overhead questions*

A direct question is a question that is *directed to a member of the class*. The correct procedure to follow when asking a direct question is to ask the question *first*, pause, and then name the student who is to give the answer. Of course, the members of the class must be made to understand that only the student who is called upon to answer should give the answer.

An overhead question is a question that is *directed to the entire class*. The correct procedure to follow when asking an overhead question is to ask the question and permit *any member of the class* to give the answer.

The following are examples of direct and overhead questions:

1. Direct: *directed to a member of the class; ask the question first, direct it last.*

Example. Why is it necessary to lubricate the dead center, John?

2. Overhead: *directed to the entire class.*

Example. Why is it necessary to lubricate the dead center?

From the foregoing examples we note that the essential difference between the direct and overhead questions is the name of the student at the end of the question. The comma preceding John indicates the pause that the shop instructor purposely makes so that *all members of the class* will think of the correct answer. Then, the shop instructor calls upon John to give the answer. This stimulates the thinking of all members of the class. As one instructor so aptly put it, "This keeps all members of the class on their toes."

Of course, if, in the course of the shop lesson, the instructor permits one or more members of the class to volunteer answers during the pause indicated by the comma, the effect of the direct question will be destroyed. As a result, discipline will tend to break down, and several members of the class will try to give all the answers. This need not happen if the instructor explains the direct and overhead questioning technique to the class.

One outstanding disadvantage to the use of the direct question in a shop lesson is the fact that it tends to *slow up the lesson.* This can occur if the instructor asks a student who does not know the answer. The student may even attempt to answer the question, but, eventually, the instructor is forced to ask another student. This takes time and tends to slow up the lesson. Sometimes the second student called upon does not know the answer and still more time is consumed. To avoid this, some shop instructors ask any member of the class to give the answer after the first student fails. In other words, the direct question is made overhead by simply saying, "Can anyone give me the correct answer?"

The overhead question does not tend to slow up the lesson but it does have several important disadvantages. Sometimes, when the overhead question is used during the shop lesson, *several students may volunteer an answer in unison.* This may not be too disturbing, but, unless the instructor is on his guard, the number of volunteer answers may increase until six, eight, ten, or even more students volunteer the answer in chorus. So loud may the chorus become that even the reticent and retiring members of the class join those who volunteered the answer in a good loud laugh. Of course, this tends to break down discipline and class morale. If this happens, *the shop instructor should use direct questions and insist on one answer.* Again, the overhead question tends to discourage thinking because the less diligent members of the class know that a certain number of students can always be counted upon to volunteer the answer. This can be eliminated if the instructor mixes direct and overhead questions during the shop lesson. As a result, these students do not know if the question is to be direct or overhead until they have thought of the answer. If the shop instructor always uses overhead questions during the shop lesson, these students are the first to "catch on," and they do not think of the answer or even listen to the question because they know it will be an overhead question which either the brilliant John Doe or the smart Percy Jones will answer.

In using direct and overhead questions during the shop lesson, the shop instructor should be aware of the advantages and disadvantages of each type of question. These advantages and disadvantages are summarized as follows:

Direct Questions

Advantages:

1. Stimulates thinking of all members of the class.
2. Tends to strengthen discipline.

Disadvantages:

1. Tends to slow up the shop lesson.
2. Tends to destroy confidence of timid students.

Overhead Questions

Advantages:

1. Does not tend to slow up the shop lesson.
2. Ideal for the preparation step in the 4-step lesson.

Disadvantages:

1. Tends to destroy discipline.
2. Discourages thinking of less diligent students.

In the foregoing we have classified questions according to two types; namely, *direct* and *overhead.* Now, we can make a further classification of direct and overhead questions according to *kinds of questions,* thus,

Kinds of Direct Questions

1. Direct information questions.
2. Direct thought questions.
3. Direct suggestive questions.
4. Direct comparison questions.

Kinds of Overhead Questions

1. Overhead information questions.
2. Overhead thought questions.
3. Overhead suggestive questions.
4. Overhead comparison questions.

The following are examples of the different *kinds of direct questions:*

1. *Direct informational: calls for information.*

Example. How many degrees are there in a right angle, John?

2. *Direct thought: requires thinking and judgment.*

Example. What, in your opinion, is the best tool for that job, John?

3. *Direct suggestive: suggests answer yes or no, or directs thinking.*

Example. This is the best class of fit for that job, is it not, John?

Example. Since we have clamped the work and everything now seems ready, what is our next step, John?

Direct comparison: calls for all kinds of comparisons, as material characteristics, comparison of processes, etc.

Example. Compare stellite and high speed steel as a cutting tool, John?

The following are examples of the different *kinds of overhead questions:*

1. *Overhead informational: calls for information.*

Example. How many degrees are there in a right angle?

2. *Overhead thought: requires thinking and judgment.*

Example. What, in your opinion, is the best tool for that job?

3. *Overhead suggestive: suggests answer yes or no, or directs thinking.*

Example. This is the best class of fit for that job, is it not?

Example. Since we have clamped the work and everything now seems ready, what is our next step?

4. *Overhead comparison: calls for all kinds of comparisons, as material characteristics, comparison of processes, etc.*

Example. Compare stellite and high speed steel as a cutting tool.

From the foregoing examples of the different kinds of questions, we, again, see that the essential difference between the direct and overhead question is the *name at the end of the question.*

In putting on a shop lesson, the shop instructor should be familiar with the advantages and disadvantages of both the direct and overhead question, and he should recognize the different kinds of questions. In addition, he should be skilled in the use of questions so that he can use the proper type and the correct kind as circumstances require.

The following techniques in questioning should aid the instructor in the effective use of questions as a device in teaching shop lessons:

1. Repeat questions for clarification and not for inattention.
2. Ask questions that can be answered; avoid catch questions.
3. Insist on individual responses to direct questions.
4. Use direct questions to strengthen discipline.
5. Use direct questions to stimulate thinking.
6. Use overhead questions to speed up the lesson.
7. Never ask questions in rotation.
8. Call on all students with reasonable frequency.
9. Fit question to the individual if possible.
10. If possible, questions should be short.
11. Use yes and no questions sparingly.
12. Have rules governing questions and answers understood.
13. Use questions to determine individual differences.
14. Questions should have definite purposes, such as, to: (*a*) obtain information, (*b*) develop the shop lesson, (*c*) to get attention, (*d*) stimulate thinking, (*e*) test learning.

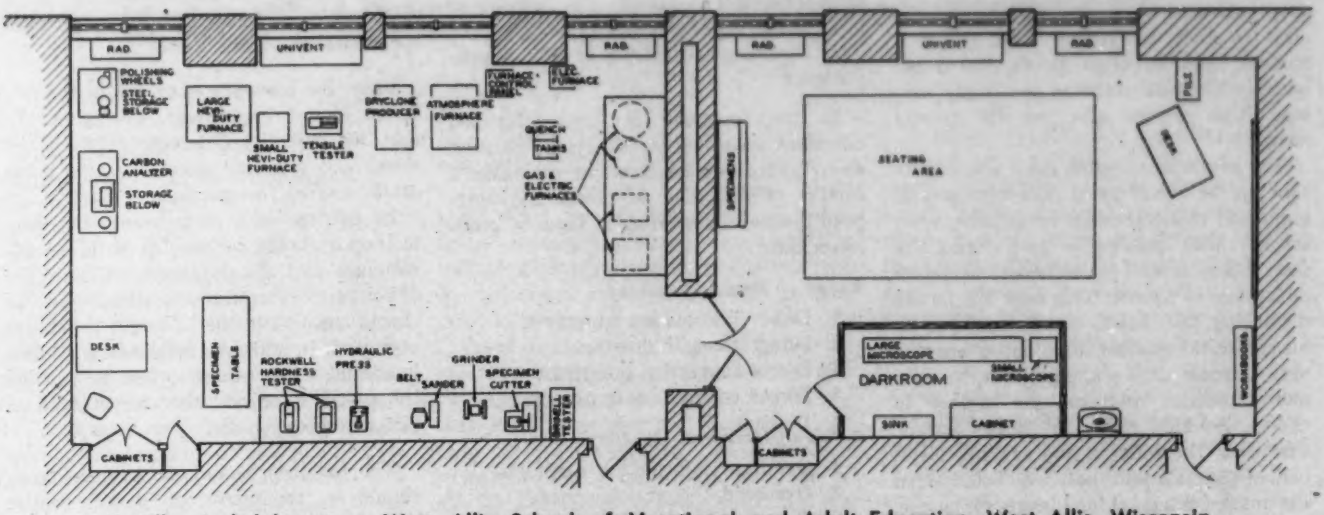
In teaching shop lessons, the question is

an indispensable device, and every shop lesson should involve the use of them. Too often, the shop instructor *tells and shows, omitting the use of questions.* This is not good practice. The shop instructor should *tell, show* and *ask* questions during a shop lesson.

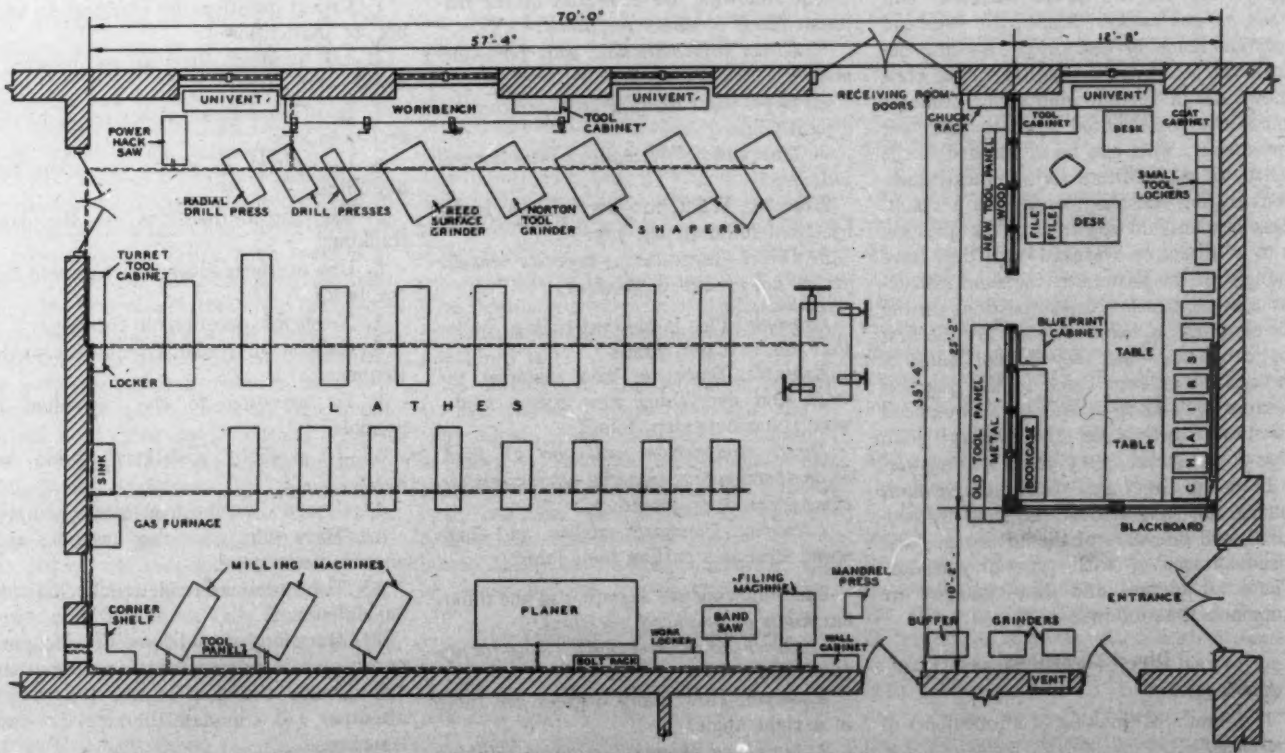
There are very definite steps to follow in teaching a shop lesson. These steps are four in number, and we call such a lesson, *"the 4-step lesson."*

(To be continued)

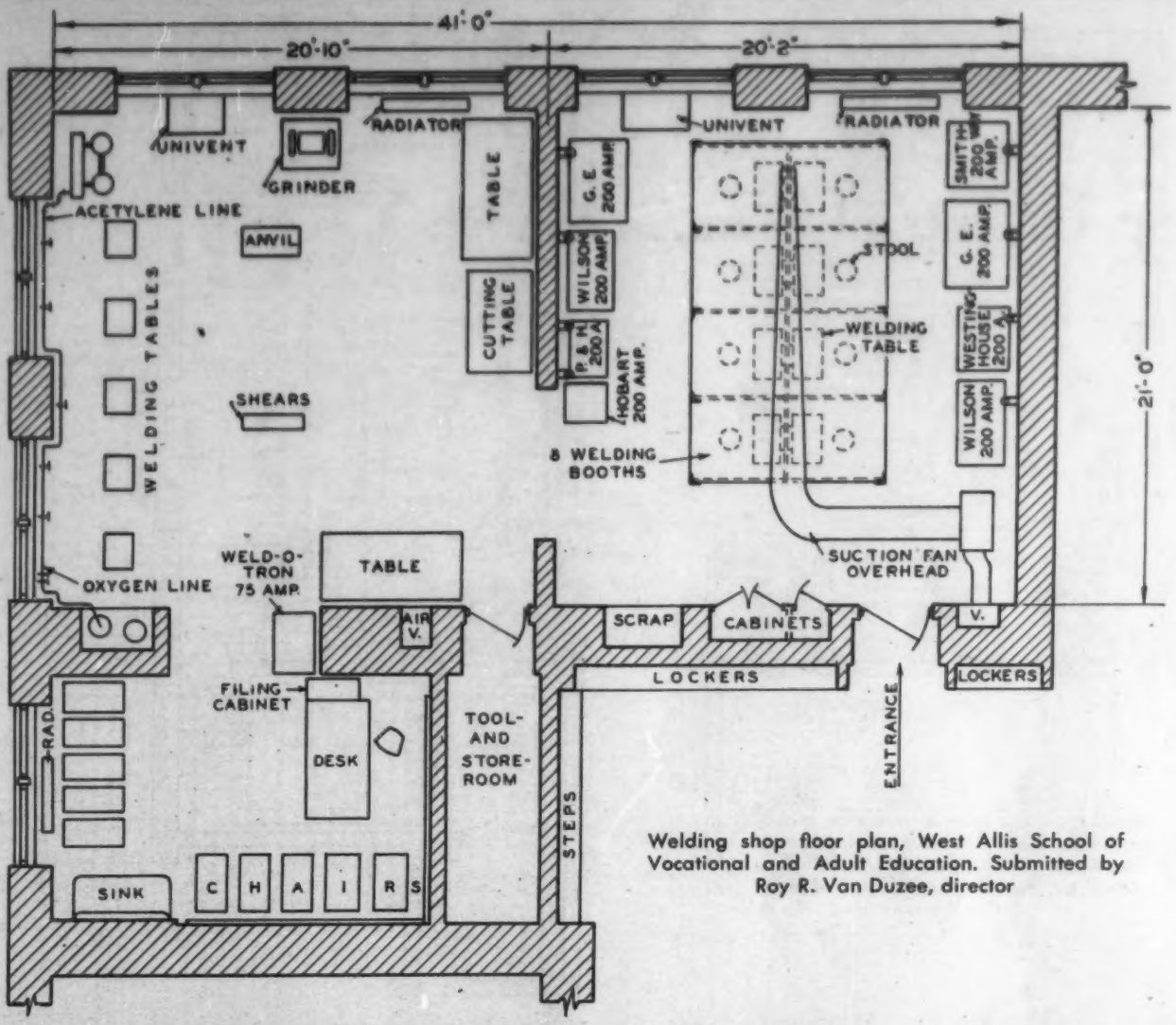
Shop Layouts of Various Kinds



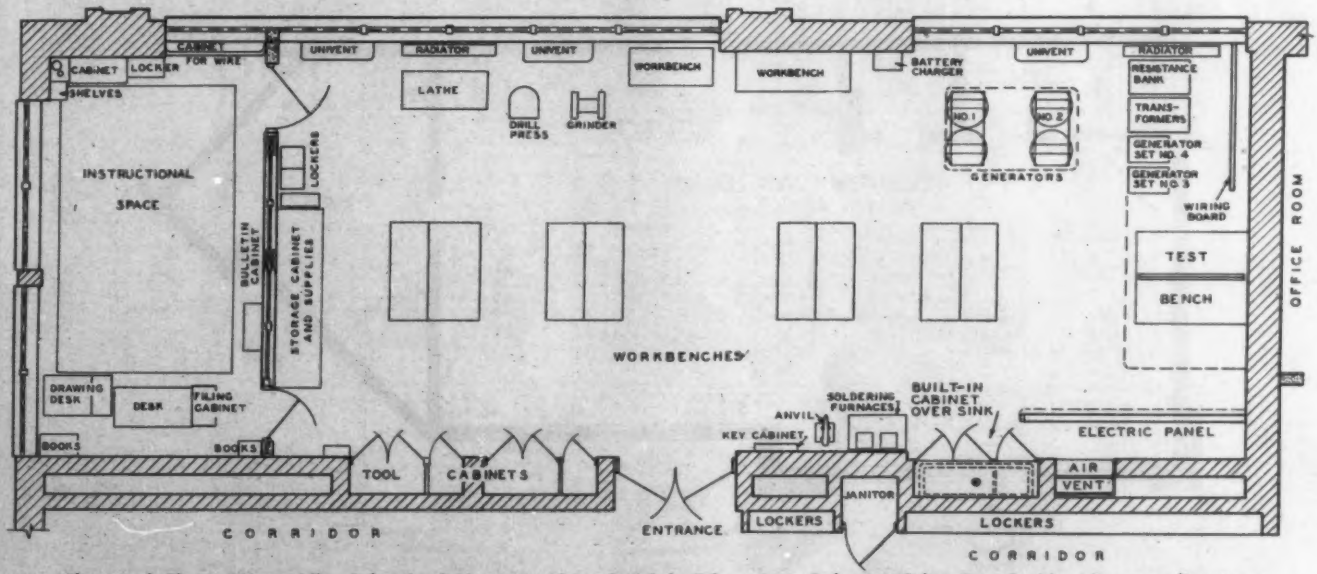
Metallurgical laboratory, West Allis School of Vocational and Adult Education, West Allis, Wisconsin
Submitted by Roy R. Van Duzee, director



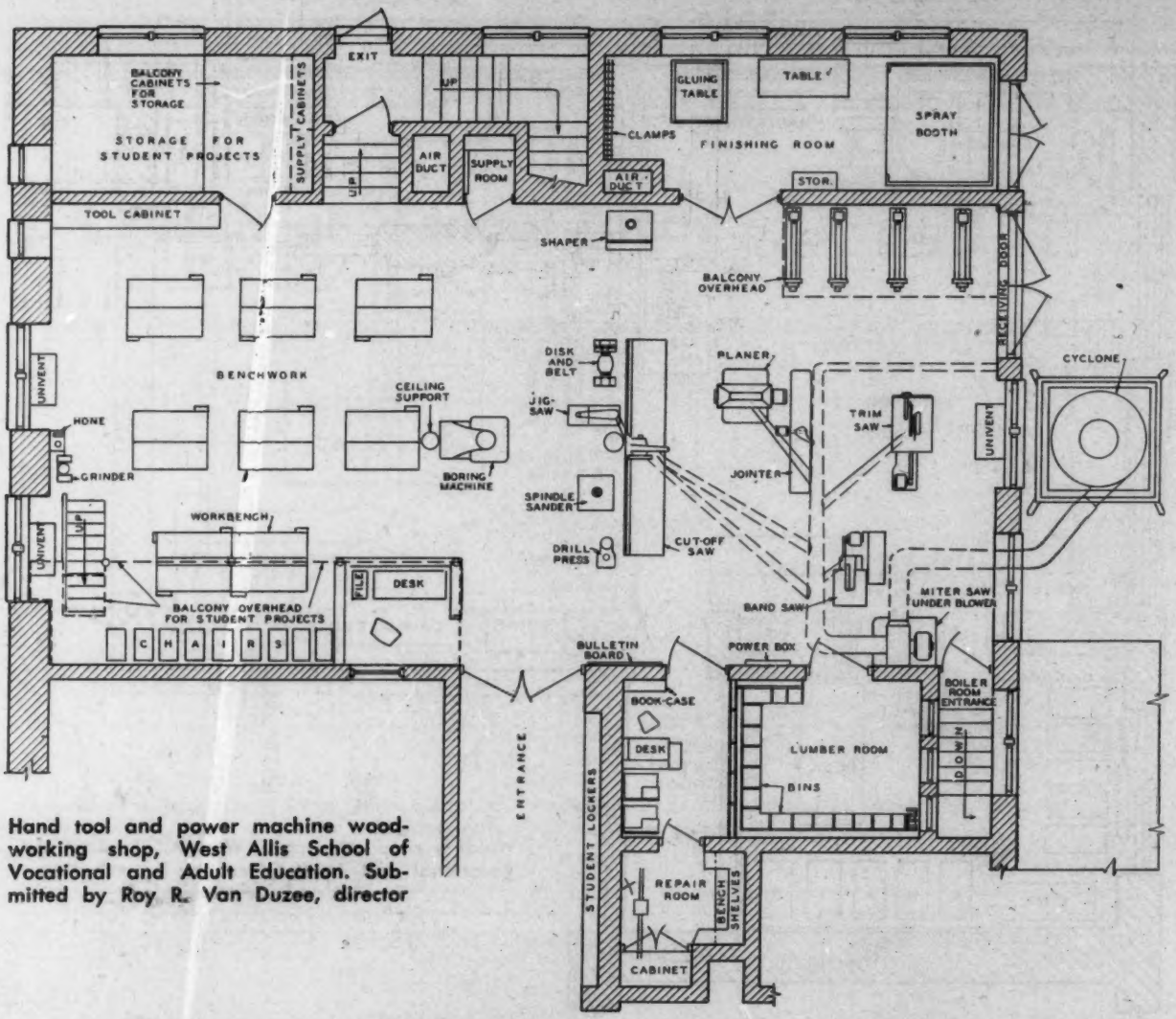
Machine shop at West Allis School of Vocational and Adult Education. Submitted by Roy R. Van Duzee, director



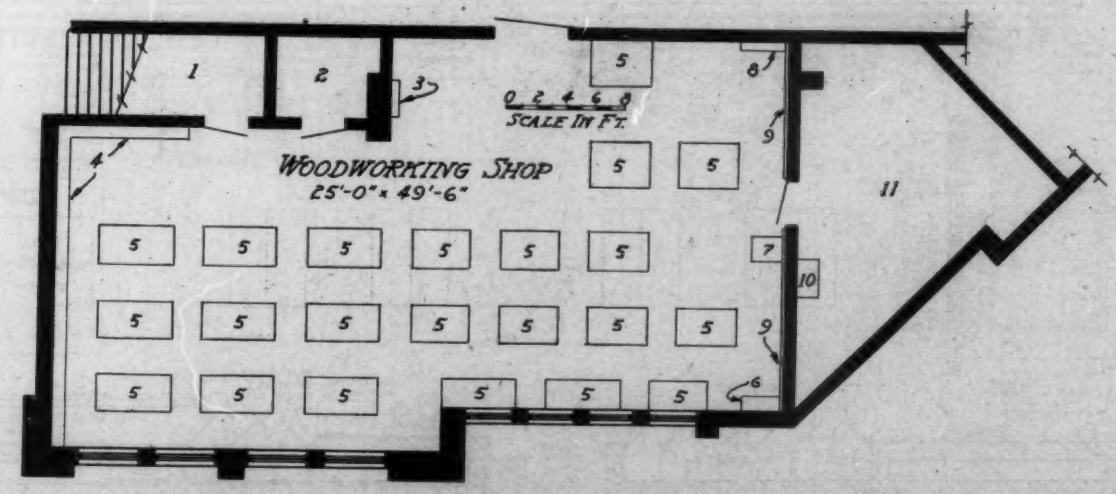
Welding shop floor plan, West Allis School of Vocational and Adult Education. Submitted by Roy R. Van Duzee, director



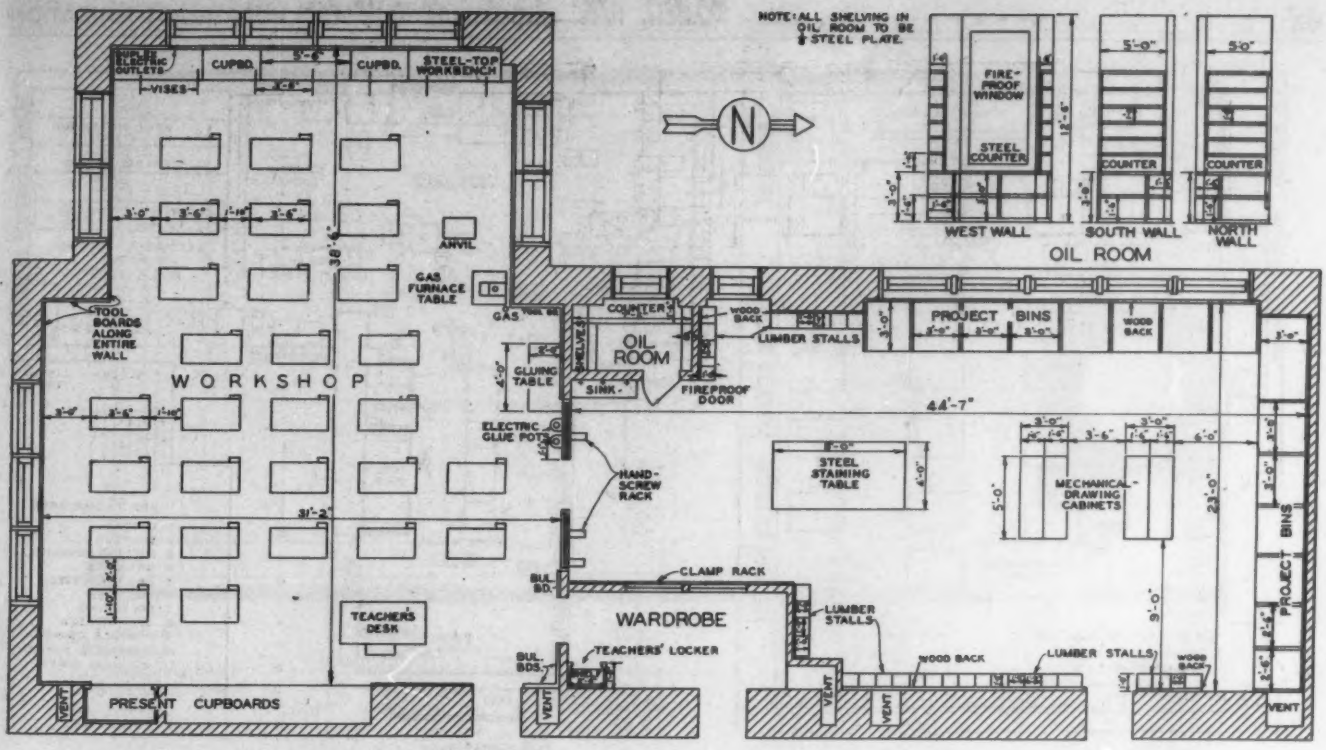
Electrical Shop, West Allis School of Vocational and Adult Education. Submitted by Roy R. Van Duzee, director

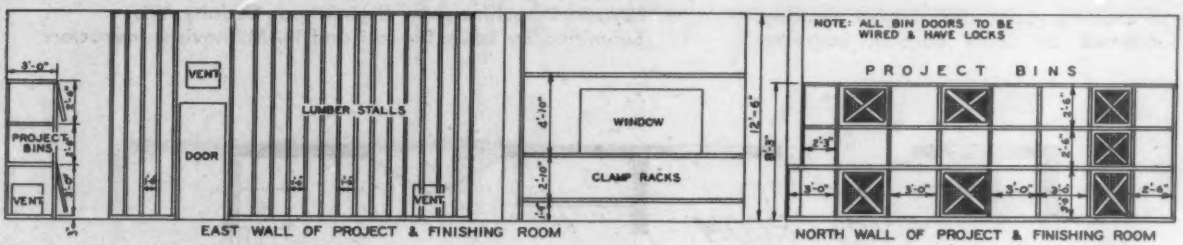


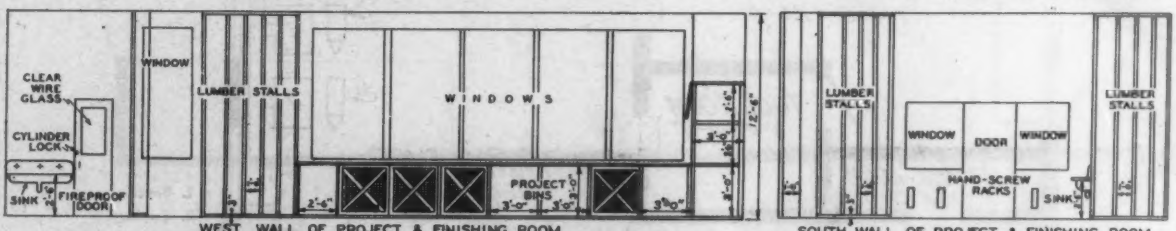
Hand tool and power machine woodworking shop, West Allis School of Vocational and Adult Education. Submitted by Roy R. Van Duzee, director

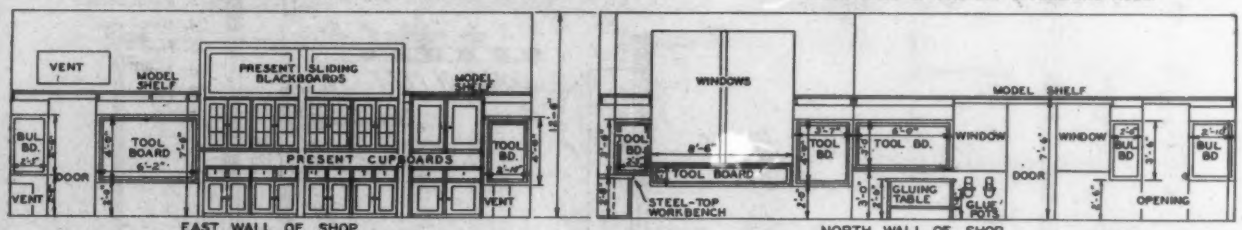


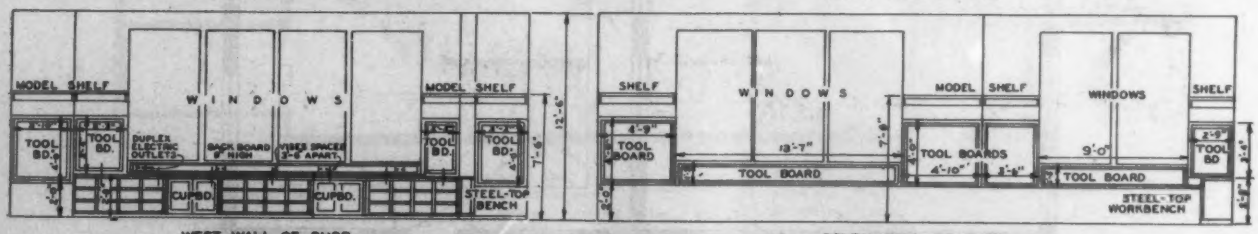
1. Storeroom under stairway
2. Toolroom
3. Key case
4. Lockers
5. Workbenches
6. Sink
7. Grinder
8. Bulletin board
9. Blackboard
10. Desk
11. Storage for projects




EAST WALL OF PROJECT & FINISHING ROOM
NOTE: ALL BIN DOORS TO BE WIRED & HAVE LOCKS
PROJECT BINS
NORTH WALL OF PROJECT & FINISHING ROOM

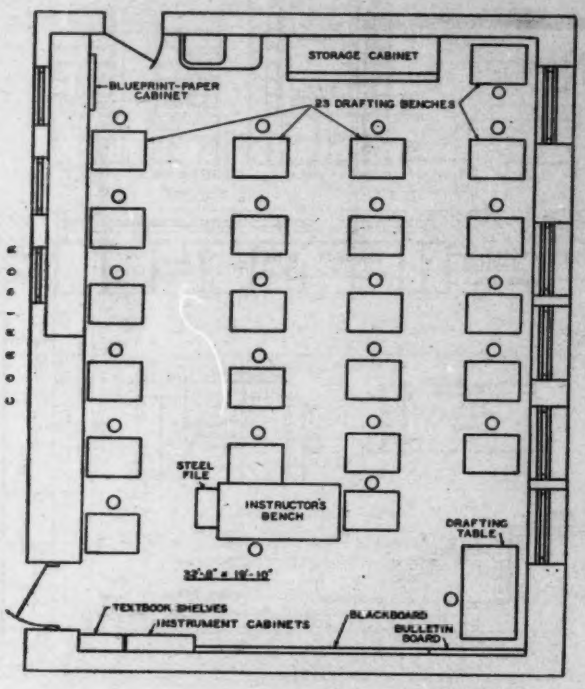




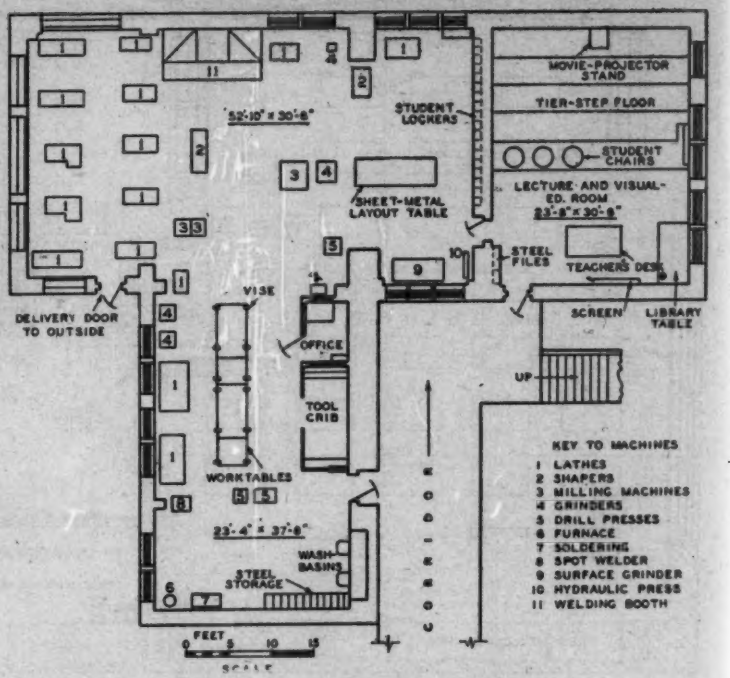


Industrial-arts shops in Garden Homes School, Submitted by Roy Radtke, supervisor of industrial arts, Milwaukee, Wis.

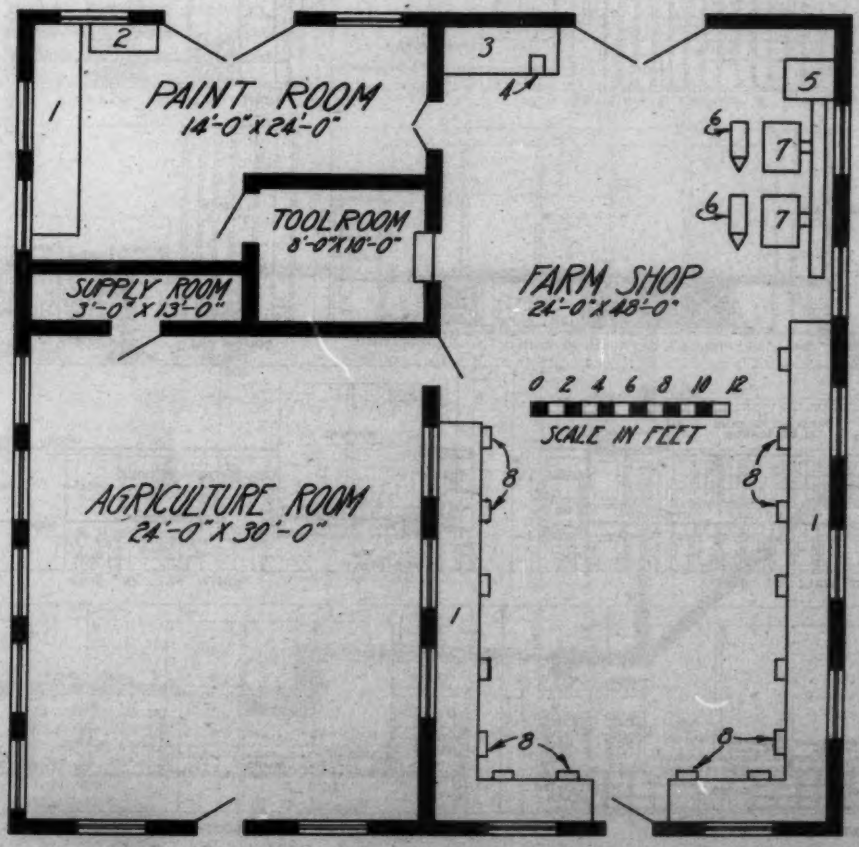
Note: Bloxonend floor in shop. Two-inch maple floor in stock room

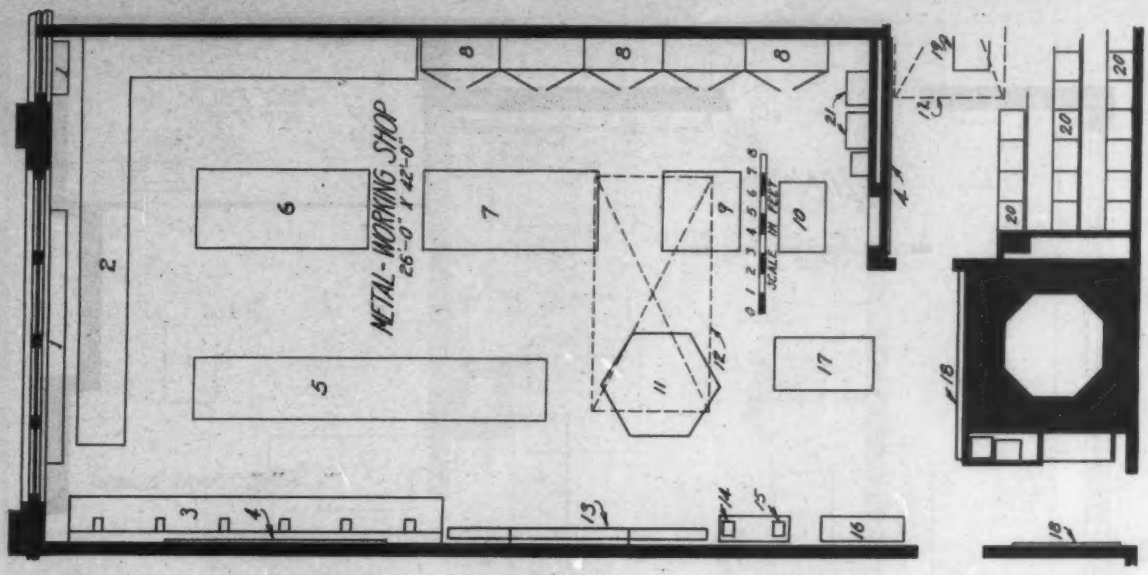


Layout of drafting room, High School, Cudahy, Wis. Submitted by Louis Barocci, instructor

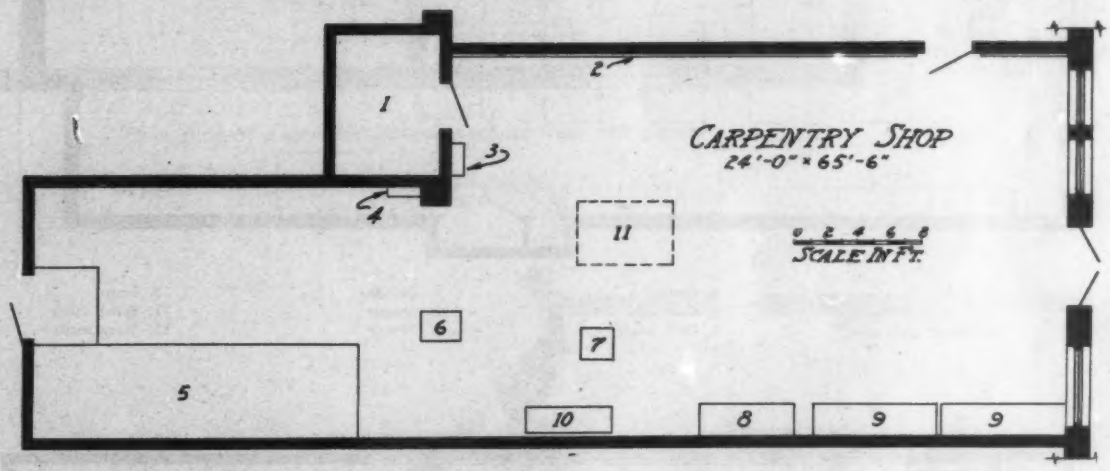


Layout of machine shop, High School, Cudahy, Wis. Submitted by Louis Barocci and N. Milinovich, instructors

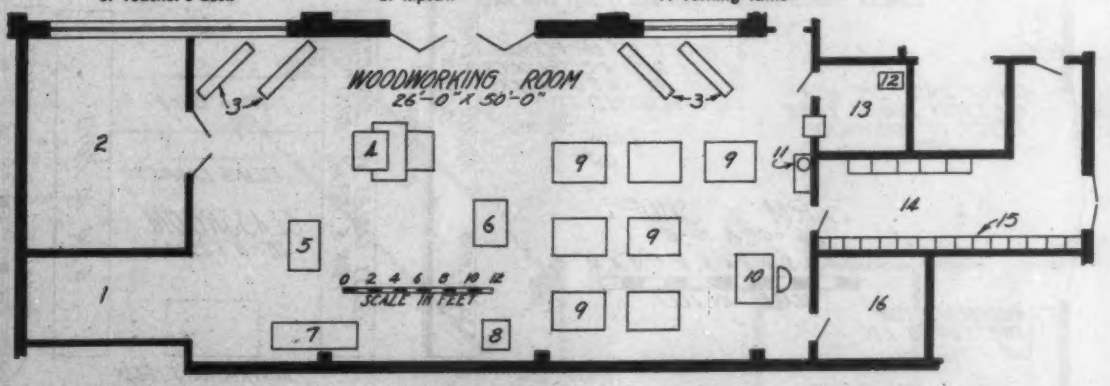




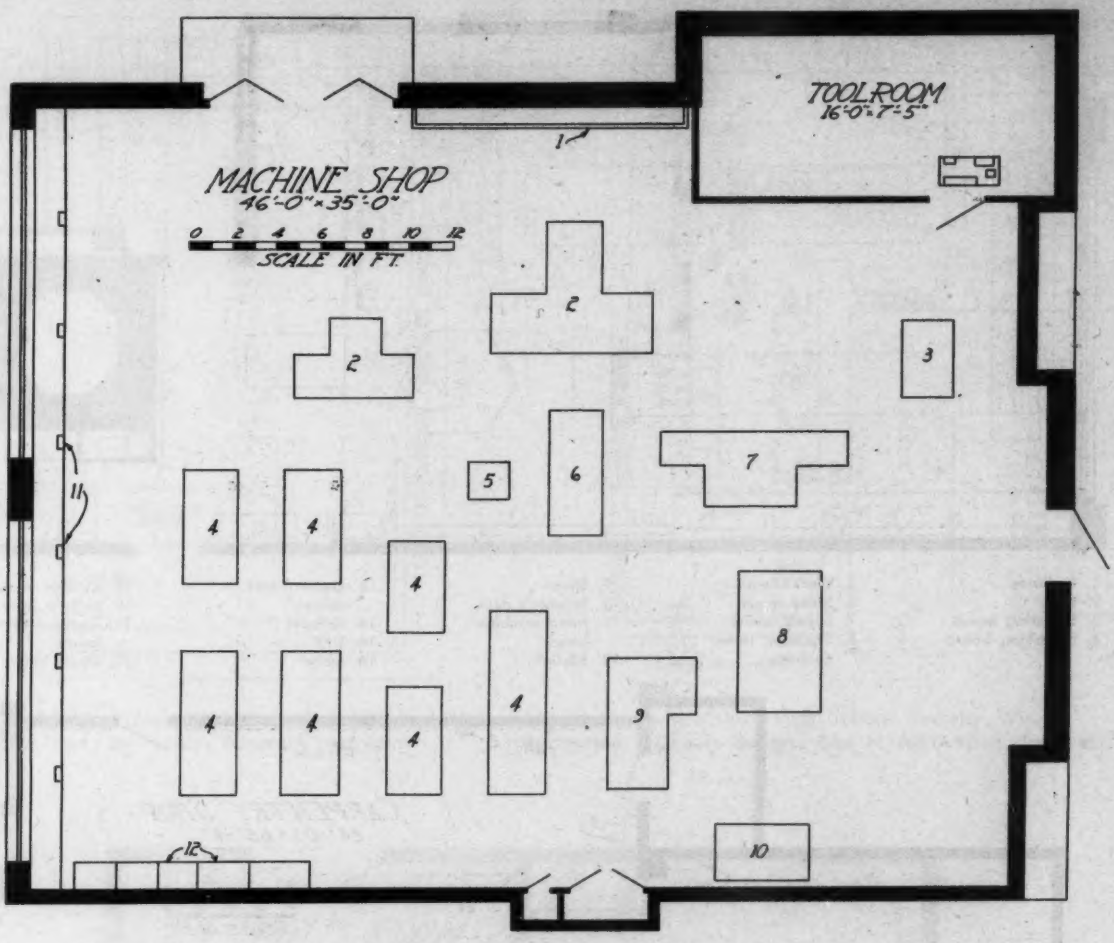
1. Radiator
2. Bench
3. Soldering bench
4. Exhibition board
5. Workbench
6. Stake bench
7. Layout bench
8. Students' locker cabinets
9. Shear
10. Teacher's desk
11. Hexo machine bench
12. Skylight
13. General tool cabinet
14. Grinder
15. Drill
16. Lathe
17. Cornice brake
18. Bulletin board
19. Demonstration bench
20. Opera chairs



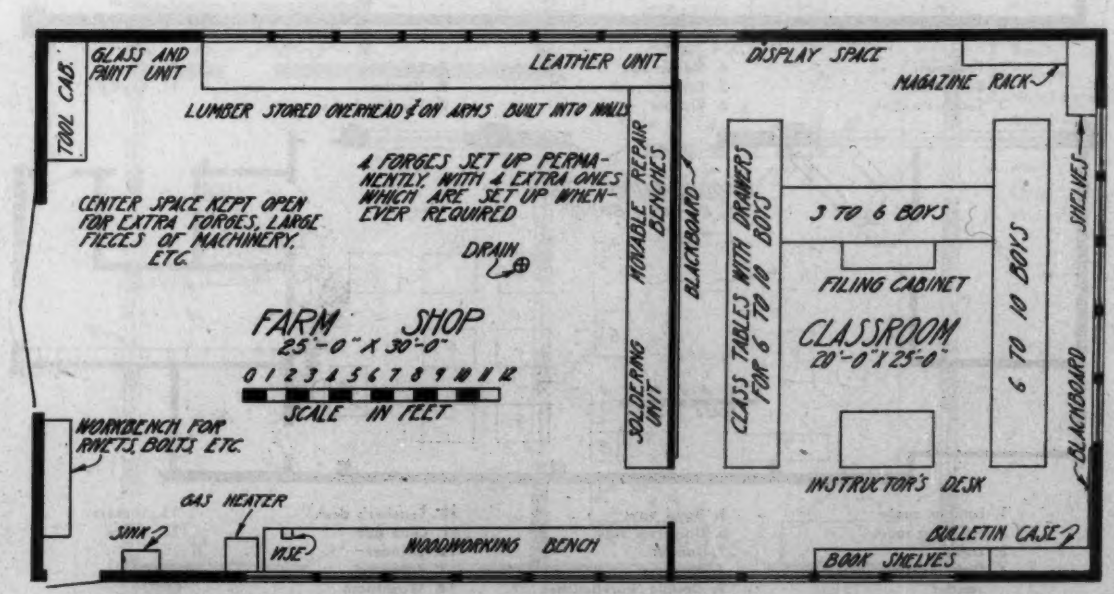
1. Toolroom
2. Blackboard
3. Teacher's desk
4. Switch box
5. Lumber rack
6. Ripsaw
7. Band saw
8. Mortiser
9. Turning lathe
10. Jointer
11. Skylight

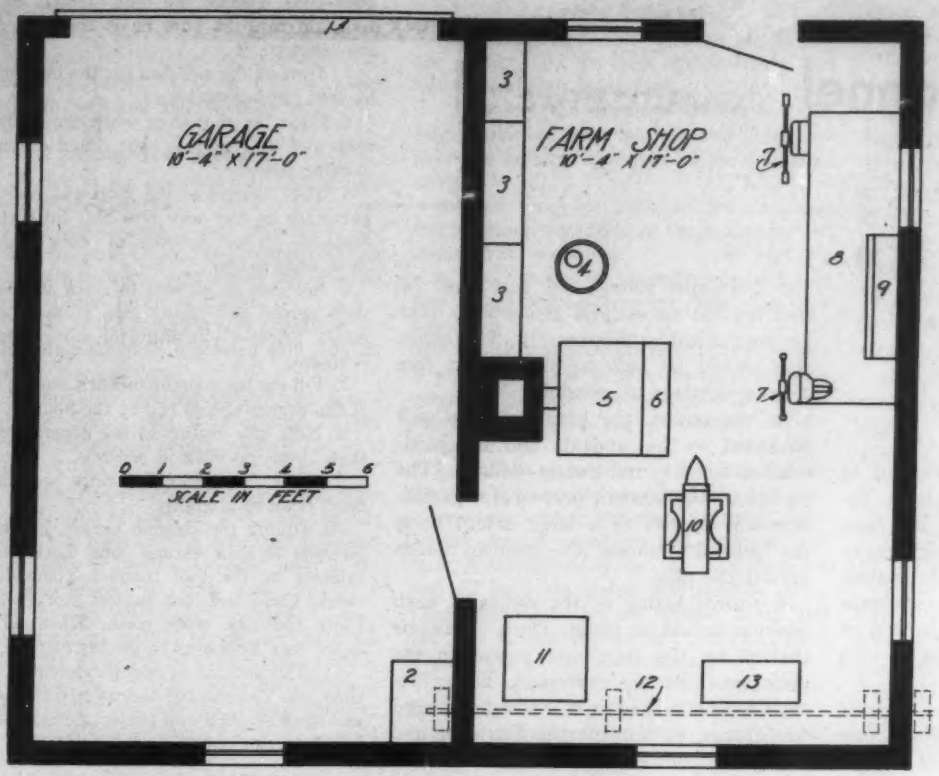


1. Lumber room
2. Finishing room
3. Lathe
4. Disk and spindle sander
5. Band saw
6. Universal saw
7. Jointer
8. Mortiser
9. Double workbenches
10. Teacher's desk
11. Glue pot
12. Grinder
13. Toolroom
14. Washroom
15. Lockers
16. Office



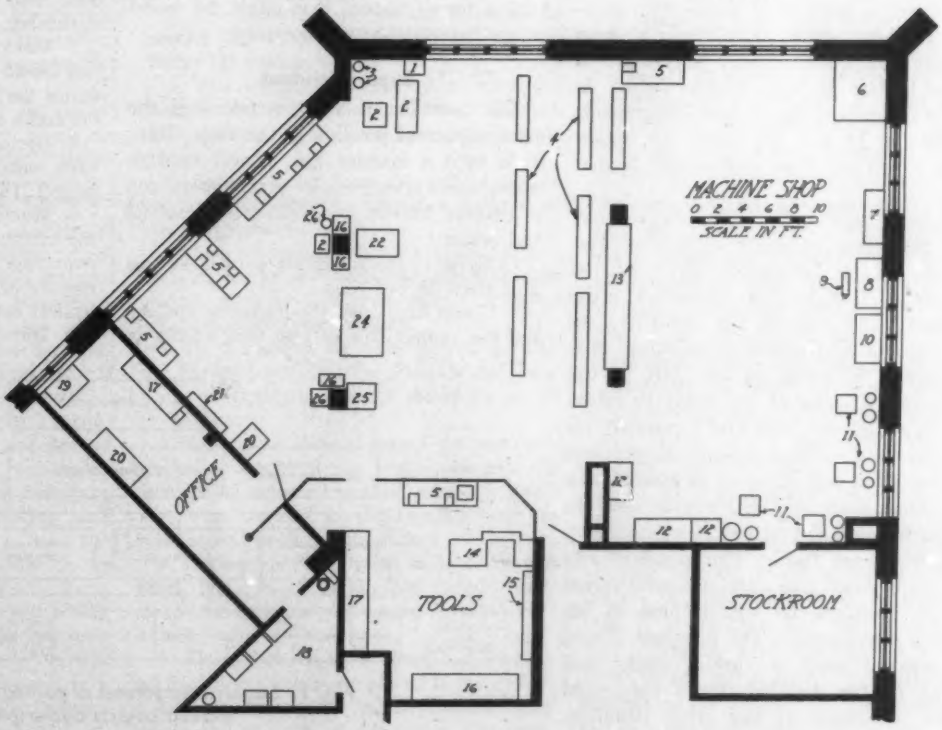
1. Sink
2. Milling machine
3. Power hack saw
4. Lathes
5. Grinder
6. Drill press
7. Grinder
8. Shaper
9. Planer
10. Forge
11. Bench vises
12. Stock racks





1. Sliding door
2. Gas engine or motor
3. Nails, bolts, and tools
4. Stove
5. Forge
6. Coal
7. Vise
8. Workbench
9. Tools
10. Anvil
11. Drill
12. Pulleys for saw, etc.
13. Grinder

Floor plan of a combination farm school shop and garage



1. Air compressor
2. Drill press
3. Oil
4. Engine lathes
5. Bench
6. Scrap box
7. Gas furnace
8. Soldering bench
9. Anvil
10. Blacksmith's forge
11. Welding outfit
12. Work cabinets
13. Bench for plumbers
14. Hack saws
15. Stock of steel
16. Shelves
17. Cabinet
18. Washroom
19. Drafting table
20. Desk
21. Display cabinet
22. Shaper
23. Grinder
24. Milling machine
25. Tool grinder
26. Grinder

Student Personnel Organization

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As the areas of activities presented in the industrial-arts laboratory have increased in number and scope, it has been expedient for the teacher to assign many of the clerical, preparatory, maintenance, and general routine duties to the students. This plan, which has been organized in varied ways, is generally referred to as a student personnel organization.

Pupils can receive valuable experience through participation in such a plan. Some of the basic values derived from a carefully planned organization are as follows: (1) broadens pupil development; (2) increases interest in work; (3) relieves the instructor of routine work and allows more time for instruction; (4) shows the pupil the value of responsibility.

In order to meet these needs, industrial-arts teachers have developed a plan whereby the pupils, under appointed or elected leaders, perform various duties. At certain designated times, these assignments are rotated to give all pupils an opportunity to occupy these positions of leadership.

Student personnel organizations may vary according to many conditions that prevail in the laboratory, such as the number in class, kind of equipment, areas of work, and age of the students. An effective and worth-while organization calls for careful planning on the part of the instructor. Because of the many variables that exist, no one plan could possibly fill all situations. The following suggestions are presented only to serve as examples in describing some of the methods used in setting up a student personnel organization.

Positions and Duties. The industrial-arts instructor must give careful consideration to the positions he will include in his student organization. The positions should be selected after a careful study and listing of the detailed duties that need to be performed in any given situation. The instructor should use care that he does not list duties and assignments that are impractical or unnecessary. The entire plan should be kept as simple and free of complications as possible.

At the outset, the plan must be well presented to the students and the justification for its use clearly defined. The success of any student personnel organization will depend to a large extent upon the general attitude the student holds toward the plan.

A formal listing of the duties of each position should be made. These should be studied by the class and posted in the areas most directly concerned. These lists should be checked and revised as need for change is felt by the students and instructor. Any given duty should be performed, not necessarily because it is included in the list of assignments for a certain position, but because it is important and necessary to the successful operation of the laboratory.

The following are some of the positions, with a list of duties, that might be found in an industrial-arts laboratory:

Superintendent

The position of superintendent is the most important position in the shop. Treat it in such a manner that it will tend to encourage students under your supervision to become leaders and followers in school and society.

1. Arrive in the laboratory as soon as possible after the bell rings.
2. Obtain keys from the instructor and unlock the project storage case that belongs to your class. Unlock the tool cabinets for the tool foreman; be sure he is there to check the cabinets.
3. Turn on the switches for the machines to be used in your section.
4. Close the shop door when the tardy bell rings and see that it is kept closed during the working period.
5. Take charge of the shop and assist the instructor in any way possible. Instruct students in proper methods of work and help them when needed.
6. See that all of your foremen are wearing their aprons and taking care of their assignments. Select a substitute for any officer that is absent.
7. Fill out the superintendent's report; check at the beginning and end of the hour.
8. Note any visitors in the department and show them the work in progress.
9. When the cleanup bell rings, see that students clean up promptly.
10. During the cleanup period, check your foremen at their various jobs. Lock the tool cabinets as the tool foreman completes his check. Close and lock project storage locker. Close and lock stock room. When all is in order, turn keys over to the instructor.
11. The position of superintendent is a full-time job. You will not be expected to complete any work on your own project during the week you hold this position.

Assistant Superintendent

1. Arrive in the laboratory as soon as possible after the bell rings. If the superintendent has not arrived or is absent, take over his assignments.
2. When the tardy bell rings, obtain the roll book from the instructor's desk and check the attendance.
3. You are an assistant to the superintendent and should check with him from time to time during the working period. He may assign you the duties of a foreman who is absent.
4. During the working period, you should have considerable time to apply to your own project. This will vary from time to time.
5. Watch the clock and ring the cleanup bell five minutes before the end of the period. Put away your own tools and materials before you ring the bell so that you may help the superintendent during the cleanup period.
6. During the cleanup period, see that

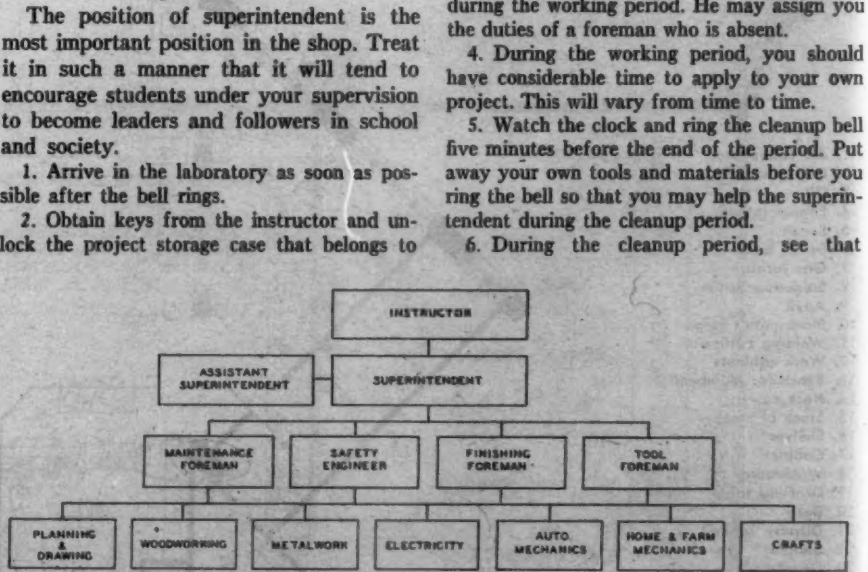

Fig. 1. Student personnel organization for a large industrial-arts department

books and magazines are returned to their proper shelves. You are responsible for checking the order of the planning room. See that drawing equipment is clean and in order. Straighten chair and table arrangement.

Hand-Tool Foreman

1. Arrive in the laboratory as soon as possible after the bell rings.
2. The superintendent will unlock the tool cabinets for you. Check the cabinets carefully as they are unlocked and report any disorder or missing tools to the instructor.
3. Tools in the precision tool cabinet in the machine tool area are to be used only with the instructor's permission.
4. During the working period you should clean any cabinet that is in disorder. Check with the instructor before making any tool repairs.
5. During the working period you will probably have time to work on your own project; however, you must keep in mind that your first responsibility is toward the hand tools in the shop. You should set aside your own work several minutes before the cleanup bell.
6. During the cleanup period, see that tools are returned to the proper cabinets and holders. Check conditions of tools and see that grease is removed from wrenches, files cleaned, shavings removed from planes, etc.
7. When cabinets are complete, close and lock. Report O.K. to the superintendent.

Finishing Foreman

1. You are responsible for the appearance and condition of the finishing room and the gluing and assembly area.
2. Check carefully at the beginning and end of the working period, and see that supplies are in good condition and in their proper places. Replace paper towels that have become soiled.
3. During the working period you should check several times to see that materials are used properly and not wasted. Each student should clean up the materials he has used and return them to their proper places.
4. You are responsible for the arrangement of the bar clamps and hand screws. Stock that is in the clamps should be neatly arranged inside the zone provided for that purpose.
5. The metal container is for rags. Have students return the rags they have used and place them in it. Oily and dirty rags should be placed in the metal container on the floor.
6. During the cleanup period, check supply shelves and see that all brushes and finishes are in their proper places. Report any supplies that are needed to the instructor. If necessary, replace the newspapers on the finishing table and glue table.
7. When all is in order, report O.K. to the superintendent.
8. During the working period, you should have considerable time to apply to your own project. The amount of time that you will have to devote to your responsibility will vary directly with the number of students using the finishing room and assembly area.

Safety Engineer

1. You are responsible for the safety of (*a*) the worker, (*b*) the tools and machines, and (*c*) the materials being used.
2. Remind the careless student of the safety rules set forth in class, and if he continues as before, report him to the instructor at once.
3. Look for loose clothing, ties, etc., that might become entangled in the machinery and endanger the workman.
4. Tools should be properly located in the tool trough when not in use, planes on their sides, etc.
5. See that only the operator of the machine is in the safety zone. The machines must be properly guarded. The guards may be removed only with the permission of the instructor.
6. You are responsible for the condition of the student storage locker. Straighten and clean if necessary, during the working period. During the cleanup period, see that students stack their materials neatly on the rack, and see that all vises are closed with handles down. Check the valves on the welding tanks and the blast furnace and see that they are closed. Report O.K. to the superintendent.
7. The amount of time necessary for you to handle your responsibility as safety engineer will vary. There will be times when you can work on your project. However, you must not become so engrossed that you will forget the important responsibility assigned to you.

Maintenance Foreman

1. The maintenance foreman will be responsible for the cleanliness of the laboratory at the end of the work period.
2. Check towel dispenser and if towels are needed, report to the instructor. Do this during the working period.
3. You should put away your work five minutes before the cleanup bell so that you will have enough time to take care of your duties.
4. Excess cuttings from the machines should be brushed under the machines and out of the safety zones.
5. You are responsible for brushing off and cleaning the jig saw, band saw, table saw, and jointer. Also the drill press, shaper, soldering bench, and sheet-metal bench.
6. At the end of the work period, see that the last students using the lathes, clean them. Chips from the metal lathe should be placed in the keg.
7. During the cleanup period, see that each student brushes off his bench and that all brushes are returned to their hooks. Students who were working in the foundry area are responsible for the cleanup there.
8. Gather up scrap wood and blocks and place them in the scrap box. Scrap paper should be gathered and placed in the wastebasket.
9. Clean wash basins if dirty and see that all used paper towels are placed in the basket.
10. See that aprons of officers are hung neatly and in order at the end of the hour. When shop is in order, report O.K. to the superintendent.

Many teachers find it expedient to designate in various ways the students holding positions. Probably one of the most common is that of having the name of the position embroidered on an apron or jacket which the student wears during the period of his service. Other methods include arm bands, large pins, or buttons. This item is important, especially in a large class, to assist the instructor in identifying the various officers and also to remind the student of his responsibility.

Assignment of Positions. In addition to the selection of positions and listing of duties, there should be some plan developed for assigning students to the various positions. This plan should be easily administered and result in each student having an equal chance to serve in all the positions.

There is a real temptation for the instructor, as he secures a smooth-running group, to hold these students on their assignments over a longer period of time. However, if one is to recognize the educational aspects and values of a student personnel organization, he will rotate these positions without regard to the ability of any given student.

Many devices have been developed by industrial-arts teachers for assigning student positions. Probably the most common method used in the past has been the rotating wheel, in which the positions and the student's name or number are placed on the circumference of two unequal-sized cardboard or wooden disks and then rotated according to a specified plan at regular intervals. A plan which seems to be more effective, is the formal listing of the class officers or positions, and the name of the student who holds the assignment. Mimeographed forms listing the positions with blank spaces for writing in the student's name could be used. There is a desirable psychological factor which must be considered as the student sees his name in connection with some responsibility.

Although the length of service will vary, depending on many conditions, about one week seems to be the usual and most common period. This amount of time allows for considerable efficiency of the plan but is not so long that younger students will lose interest.

Some method of breaking in the new officers is desirable. Most teachers feel that it is valuable for the student who just previously held the position to spend some time instructing or assisting the student newly assigned to the position on the day the organization is rotated.

Localized Tool Panels

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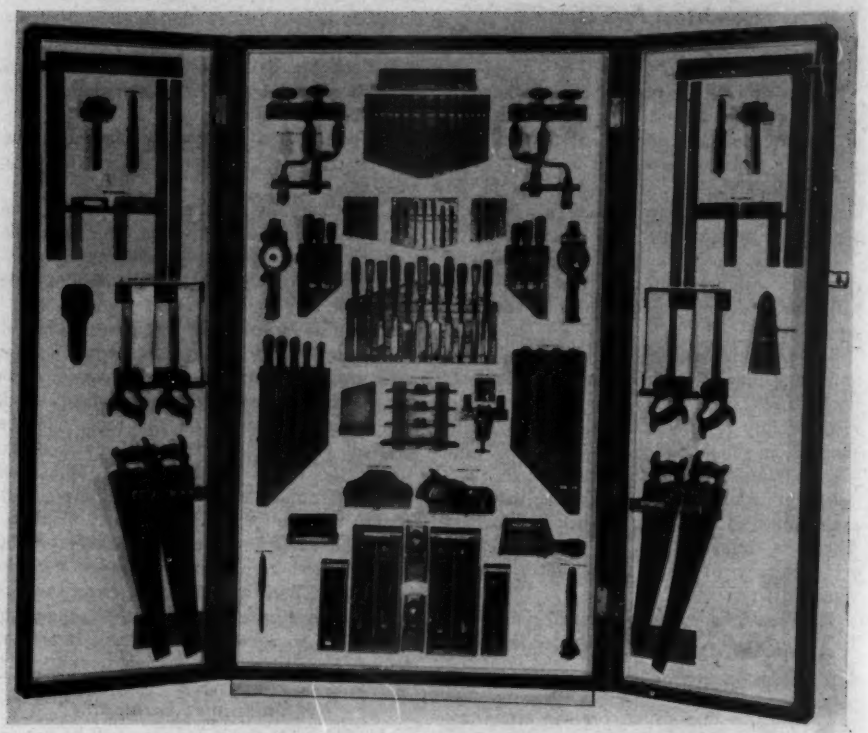

Fig. 1. Localized tool panel in the woodworking area

The use of localized tool panels seems to fill the need most adequately for the industrial-arts laboratory where a number of areas are represented. This plan requires a tool panel for each general area represented, usually mounted on a wall adjacent to the area served. These panels require careful planning. The design should include some method of locking or otherwise securing the tools.

Tool holders, such as those shown in Figure 1, should be developed. They should include some of the following features:

1. Hold tool in one position. Preferably this position should be secured without having to revolve or change natural holding points.
2. Hold tool securely and protect it from damage. Also protects student.
3. Made of hardwood or metal to withstand wear.
4. Easily cleaned and maintained.
5. Attached to tool panel with screws to facilitate replacement or rearrangement.
6. Includes silhouette, name, and size of tool.

Tool panel arrangements should be considered as to appearance, usability, and safety. For example, tools may be arranged in a symmetrical or interesting pattern and also grouped in relation to their uses. Pointed and edged tools should not be hung above eye level. The panel and holders should be carefully finished in natural shades or with enamels.

An Outline for Industrial-Arts Casting

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Casting is the product obtained after pouring molten metal into a sand mold of the desired size and shape.

Flask — a box open at top and bottom, usually made in two sections, the lower part of which is known as the drag, and the upper part, the cope. The drag and cope are fitted with guides and cleats to permit accurate alignment of the two sections.

Pattern — is simply a form from which a mold can be made that will produce a casting of the desired shape and size.

Steps in Making a Mold

a) Lay pattern face down on molding board.

b) Invert the drag around the pattern.

c) Properly dampened sand (tempered sand) of proper consistency is rammed around pattern until drag is filled. The sand is then leveled off with straightedge.

NOTE: (1) Tempered sand is not ordinary beach sand which is generally too coarse, but regular foundry sand obtained from a foundry supply house. (2) To test for proper consistency of sand squeeze a handful of sand into a lump. If it retains its shape and shows all finger marks it is right. If it crumbles it is too dry, and if it leaves moisture on the hands it is too wet.

d) Turn drag right side up on molding board.

e) Sprinkle surface with parting material to prevent sticking.

f) If pattern is in two pieces, the seconded piece is now set in place.

g) Set cope on the drag.

h) A sprue pin is placed in cope to form pouring hole.

i) Cope is now rammed with sand.

j) Lift off cope and remove pattern.

k) Cut a pouring hole and gate in the sand for the molten metal.

l) Replace cope on drag.

Hints in Pouring

a) Permit no molten metal to strike wood, paper or anything inflammable.

b) Have a clear gangway between pouring area and the furnace.

c) The pouring should be done only where the shop floor is of concrete or where there is a deep bed of dry sand.

d) Always maintain a firm and controlling grip on the crucible.

e) The two halves of the flask must be held together as there will be a tendency for the cope to float when the metal is poured.

f) Always pour the molten metal against the side of the sprue hole so that it flows gently into the mold.

g) Never hold the crucible so high that the molten metal will fall with excessive force.

h) When mold is filled, set it aside until the metal has solidified.

i) Pour excess metal in crucible into a cavity in the sand.

Hints in Designing Articles to Be Cast

a) Have as few changes in thickness as possible.

b) When change in thickness is necessary the change should be made gradual.

c) Thick and thin sections of castings will not cool at the same rate.

d) Where there is a considerable difference in thickness, there will be a difference in shrinkage which makes warping inevitable.

e) Whenever possible, always design castings with constant thickness.

Notes on Patterns

a) Patterns are usually made of pine and a few hand tools. No fancy woods or elaborate equipment is needed.

b) Patternmaking woods should be well dried and seasoned. If pattern is subject to repeated use, the following woods should be used: maple, cherry, mahogany, redwood. For ordinary work clear white pine is used.

c) Lay out and construct pattern carefully as errors in the pattern will be reproduced in the casting.

d) Pattern must allow for sufficient metal on the casting for machining.

e) The pattern is invariably larger than the finished casting.

f) The pattern must be made such that it can be removed from the mold without breaking either the mold or the pattern.

g) In all cases it is necessary to make patterns with tapered sides or *draft*. This makes it easy to remove the pattern from the mold.

h) Where possible, the pattern is made with the draft all running in one direction from parting line.

i) When the pattern is made in two pieces, the draft will run in both directions from the parting line.

j) The amount of draft on patterns to be used for castings made of cast iron should be ⅛ in. to the foot.

k) Irregular-shaped patterns are usually made with ordinary hand tools and carving chisels.

l) In split patterns it is best to make the pattern out of two pieces of clear white pine, the joint between the two parts corresponding to the parting line.

m) When a pattern is finished, dowels are inserted to hold the two halves in place.

n) For small patterns it often helps to use a square dowel.

o) The dowels are always glued in the cope half of the pattern, never in the drag section.

p) Holes for the dowels in the drag half should be large enough so that the two halves of the pattern will pull apart, yet sufficiently tight to prevent any play between the two parts.

q) The completed pattern should be sanded lightly with fine sandpaper and then shellacked.

r) When a pattern is of such a shape that it cannot be made with the draft running in one direction from the parting line, a split pattern of two or more pieces is necessary.

Shrinkage

a) All castings shrink after solidification.

b) Amount of shrinkage depends on metal used.

APPROXIMATE SHRINKAGE OF CASTING

cast iron	1/8 in. per foot
brass	3/16 in. per foot
aluminum	1/4 in. per foot
zinc	5/16 in. per foot
copper	3/16 in. per foot
lead	5/16 in. per foot
malleable iron	1/8 in. per foot
steel	1/4 in. per foot

c) Patterns are laid out with shrink rule instead of an ordinary rule: (1) A cast iron shrink rule is increased ⅛" per ft. (2) A brass shrink rule is increased 3/16" per ft. (3) All subdivisions are elongated proportionately.

Fillets

a) When wood parts of a pattern join at right angles, a fillet is needed: (1) Triangular leather fillets are applied with glue. (2) Beeswax fillets are used on smaller patterns.

b) In all castings it is necessary to avoid square edges and corners as much as possible. Outside edges of castings should be rounded off and inside corners should be filled in.

Notes on Cores and Coring

When a hole in a casting must have straight sides (no draft) or when it is in such a position that it cannot be formed as a part of the pattern, the hole must be made by coring.

a) Dry-sand cores are usually made in a core box of the proper shapes and then baked dry.

b) The core is made from common molding sand to which binding material such as linseed oil, molasses, or flour is added.

c) When making long and slender cores, iron wires are inserted in the core box to reinforce the cores along the length.

d) Cores are placed in an oven at 400 deg. F., and baked slowly to remove all excess moisture.

OCCUPATIONAL ACCIDENTS

Deaths from occupational accidents in 1946 totaled 16,500 — about the same number as in 1945. Total all-industry employment increased about 3 per cent, but manufacturing employment alone went down 6 per cent.

Disabling injuries from work accidents numbered approximately 2,050,000. The economic loss totaled about $2,350,000,000.

Coal mine deaths totaled 851 in the first 11 months of 1946 — 9 per cent under the 1946 figure. — *National Safety Council.*

When lifting heavy objects follow these simple rules:

Get a good footing, bend at the knees to grasp the weight, keep the back straight, keep the back as upright as possible, get a firm grip, then lift gradually by straightening the legs. When the weight is too heavy or bulky — get help! — *National Conservation Bureau.*

Industrial safety engineers of the National Conservation Bureau and the Liquefied Petroleum Gas Research Committee say the precautionary word used for labeling various containers and combustible materials should be "flammable" not "inflammable." The latter has been more or less commonly used, but technically the prefix "in" means "will not."

The Bureau and Committee suggest that manufacturers use the less confusing word "flammable" to mark their combustible products, because "inflammable" might mean "not able to burn" to new workers.

Analysis Chart for Plumbing Apprentices

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Jobs and operations

1. Roughing-in and pipe fitting for
   - A. Pipe and fittings
     1. Screwed
     2. Sweated
     3. Bell and spigot
     4. Lead
2. Plumbing installations
   - A. Simple fixture installation
     1. Connecting a water service to city main
     2. Installing a water meter
     3. Cutting, threading, reaming, and making up fitting on brass, copper, and nickel plated pipe
     4. Roughing-in and testing water supply line
     5. Refrigerator drain installation
     6. Installing range boilers and gas heaters
     7. Installing a kitchen sink
     8. Installing a laundry tray
     9. Installing a lavatory
     10. Installing a bathtub
     11. Installing a water closet
   - B. Advanced fixture installation
     1. Installing flush valves
     2. Installing urinals
     3. Installing shower baths
     4. Installing automatic heaters and storage systems
     5. Installing drinking fountains
     6. Installing slop sinks
   - C. Drainage and ventilation work
     1. Cutting soil pipe
     2. Operation and care of furnace and blowtorch
     3. Calking a vertical soil joint
     4. Laying a house sewer
     5. Roughing-in the house drain and ground lines
     6. Roughing-in a soil stack
     7. Cutting, threading, reaming, and making up screw pipe work
     8. Roughing-in the drainage and ventilation of a bathroom
     9. Roughing-in the drainage and ventilation of a kitchen sink
     10. Roughing-in the drainage and ventilation of a laundry tray
     11. Testing soil pipe work
   - D. Gas fitting
     1. Installing service lines
     2. Installing supply lines
     3. Testing gas lines
     4. Installing gas meters
     5. Connecting gas ranges and gas stoves
   - E. Lead work
     1. Care of solder iron
     2. Tinning of brass, copper, etc.

Trade terms, tools, materials, and science principles

1. Trade terms
2. Tools
3. Straight run pipe fitting (specifications for screwed, sweated, bell and spigot, pipe and fittings)
   - A. Pipe data
     1. Use of tables
     2. Wall thickness
     3. Thread length
     4. Weight per foot
     5. Proper nomenclature for ordering
   - B. Fitting data
     1. Pressure code
     2. Depth of thread
     3. Use of tables
     4. Proper nomenclature for ordering
   - C. Pipe hangers
     1. Hanger data
        - *a*) Use of tables
     2. Temporary hangers
        - *a*) Wire
        - *b*) Rope
   - D. Staging and scaffolds
     1. Construction
4. Basic plumbing science principles
   - A. Corrosion of metals
   - B. Resistance to corrosion
   - C. Characteristics of water
   - D. Characteristics of sewer gas
   - E. Cutting compounds
   - F. Septic tank action
   - G. Action of fluxes
   - H. Elecrolytic damage to water pipes
   - I. Use of caustic soda and drain solvents
   - J. Mixing plaster of Paris, litharge-glycerine, putty and cement
   - K. Lubrication
   - L. Mass
   - M. Structure of matter
   - N. Force — work
   - O. Heat and expansion
   - P. Mechanics of liquids
   - Q. Mechanics of gases
   - R. Siphonage
     1. Loss of seal
   - S. Hot water circulation
   - T. Combustion of fuels
   - U. Action of simple pumps
   - V. Use of air chambers
5. Function and operation of water closets
   - A. Siphon jet
   - B. Siphon
   - C. Reverse trap
   - D. Washdown
   - E. Blowout
   - F. Frostproof
6. Function and operation of fixture appurtenances
   - A. Flushing devices
     1. Flushometers
     2. Flush tanks
        - *a*) Urinals
        - *b*) Water closets
     3. Bibbs
   - B. Valves
     1. Gate valves
     2. Globe valves
     3. Pressure reducing valves
     4. Compression cocks
     5. Mixing valves
7. Operation and construction of water softeners
   - A. Types
     1. Commercial
     2. Domestic
     3. Industrial
8. Plumbing rules, regulations, and requirements for house and building drainage
   - A. Ordinances
   - B. Plans and specifications
   - C. Filing plans and specifications
   - D. Duty of owners and plumbers in constructing drains and connections
   - E. Inspection and approval
   - F. House and building drains
     1. Material of house or building drains
        - *a*) Sizes
          - (1) Diameter

Shop mathematics

1. Review of fundamental processes
   - A. Fractions
   - B. Decimals
   - C. Percentage
   - D. Ratio and proportion
   - E. Solving simple equations and formulas
   - F. Squares of numbers
   - G. Square root
   - H. Angles
   - I. Circles, elements of
2. Computing areas
   - A. Rectangular
   - B. Triangular
   - C. Circles
   - D. Trapezoid
   - E. Cone
   - F. Cylindrical
   - G. Pyramid
3. Computing volumes (cubage)
   - A. Cube
   - B. Cylinder
   - C. Cone
   - D. Frustrum of cone
   - E. Pyramid
   - F. Frustrum of pyramid
   - G. Regular and irregular tanks
4. Measuring systems in construction work
   - A. Architects' elevation system
     1. Bench marks
     2. Contour lines
     3. Floor levels
     4. Column marking
   - B. Decimal system in elevations
     1. Digit nomenclature
     2. Measurements with the decimal system
        - *a*) Elevations
   - C. Six-foot rule system
     1. Foot, inch, and fraction of an inch system
   - D. Tie-in between fractional and decimal systems
     1. Convert decimal of foot to feet, inches and fraction of inch
     2. Convert inches and fractions of inch to decimals of feet
     3. Tie-in both systems with percentage system
5. Straight run pipe fitting

   Measurements for screwed, sweated, bell and spigot, pipe and fittings
   - A. Pipe data
   - B. Fitting data
   - C. Combination of pipe and fitting data for figuring measurements
     1. End to end
     2. Center to center
     3. Center to end
     4. Center to face
     5. Face to face

Blueprint reading, drawing, and estimating

1. Freehand drawing
   - A. Basis of useful sketching
     1. Lines (horizontal, vertical, angular)
     2. Circle
     3. Tangents
     4. Dimensioning
     5. Use of scale, triangles, compass, and protractor relative to piping drawings
   - B. Geometric applications
     1. Geometry and sketching relationships
     2. Uses of geometry in sketching
     3. Various curved figures
   - C. Principles of projection
     1. Methods of representation
     2. Working drawings
     3. Planes of projection
     4. Representation of hidden surfaces
     5. Auxiliary views
   - D. Sectional views
     1. Representation of interior construction
     2. Principle of the sectional view
     3. The imaginary cutting plane
     4. Kinds of sectional views
     5. Exceptions to the rule of sectioning
   - E. Isometric sketching applied to piping drawings
     1. Pictorial representation
     2. Principles of isometric drawing
     3. Isometric sections
2. Reading construction plans
   - A. Interpreting the plans
     1. Floor plan
     2. Elevations
     3. Sectioning
     4. Symbols
     5. Conventions
3. Reading piping drawings
   - A. Symbols
   - B. Interpretation of piping arrangement
   - C. Piping construction procedures
4. Piping layouts
   - A. Straight pipe runs
   - B. Offset distances
     1. 45 deg.
     2. 60 deg.
     3. 30 deg.
     4. 22½ deg.
     5. 11¼ deg.
     6. 5⅝ deg.
   - C. Layouts of rolling offsets
5. Plumbing drainage, ventilation, and fixture layouts'
   - A. Drainage and ventilation for
     1. Unit installation
        - *a*) Kitchen sink connections
        - *b*) Laundry trays connections
        - *c*) Water closet connections
        - *d*) Bathroom group
        - *e*) Raised rear vent applied to different types of water closet
          - (1) For floor elevation layout of

4. Installing gas meters
5. Connecting gas ranges and gas stoves

and connections
E. Inspection and approval
F. House and building drains

1. End to end
2. Center to center
3. Center to end

b) Laundry trays connections
c) Water closet connections
d) Bathroom group

E. Lead work
1. Care of solder iron
2. Tinning of brass, copper, etc.
3. Preparing and soldering lead seams
4. Making roof flashings
5. Mixing and care of wiping metal and strip solder
6. Making wiping cloths
7. Preparing and wiping joints

3. Maintenance and repair work
A. Stoppages in sewers and traps
1. Locating stoppage
2. Removing stoppage
3. Prevention of further stoppage

B. Faucet and valve repairs
1. Sink, lavatory, and bathtub repairs
2. Globe valve, compression stop, and waste repairs
3. Closet valve repairs

C. Heater and range boiler
1. Repairing boiler leaks
2. Cleaning the heating unit
3. Repairing heater coils

D. Gas repairs
1. Testing for leaks
2. Repairing leaks
3. Adjusting burners

E. Water lines
1. Thawing frozen lines
2. Repairing bursted or corroded lines
3. Freezing a line to make a repair

F. Group fixture installations
1. Roughing-in soil lines
2. Roughing-in vent lines
3. Roughing-in waste lines
4. Fixture roughing-in and installation for
a) Wash basins
b) Gang showers
c) Water closets
d) Urinals
e) Fixture combinations

G. Septic tanks
1. Locating
2. Excavation
3. Installing
a) Cast iron roughing-in
b) Terra cotta lines
c) Building concrete forms
d) Mixing concrete and cement
e) Installing steel tanks

1. Material of house or building drains
a) Sizes
(1) Diameter
(2) Fall ¼ in. per foot
(3) Fall ½ in. per foot
2. Location of main trap
3. Fresh air inlet and connections
4. Laying of house sewers and drains
5. Location of house sewers and drains
6. Drains outside of building
7. Material of sewers between buildings
8. Floor drains
a) Floor *b*) French drains
9. Weight and thickness of cast iron soil pipe and specifications
10. Subsoil drains
11. Yard and area drains
12. French, subsoil, foundation, clear water, and absorption tile drains
13. Use of old house drains and sewers
14. Leader pipes
15. Material for inside and outside leaders
16. Trappings of leaders
17. Use of leaders
18. Exhaust from steam pipes
19. Diameter of soil pipe for
a) Sizes for
(1) Soil and waste combined
(*a*) Branch (*b*) Main
(2) Soil pipe alone
(*a*) Branch (*b*) Main
(3) Fixture count tables
20. Changes in direction of all sewer, soil, and waste pipes
21. Joints for soil and waste pipes

G. Roughing-in fixture traps
1. Fixtures traps
a) Number of traps permitted on various size waste pipes
b) The size of traps and waste branches for a given fixture
(1) Kind of fixture (3) Size of branch
(2) Size of trap
2. Overflow pipes connections
3. Sediment pipes connections
a) From kitchen boilers
4. Setting of traps and traps without re-vent
5. Safe and refrigerator waste pipes
a) Connections *c*) Branches on vertical lines
b) Traps *d*) Tenement and lodging houses
6. Acid waste installation

H. Vent pipe installations
1. Material for vent pipes
2. Ventilation of traps and soil lines
a) Size of pipe
(1) Maximum developed length in feet
(*a*) Main
(2) Number of 1½-in. traps vented or equivalent
(*a*) Branch
(*b*) Main vertical
(3) Branch vent pipes (5) 3-in. main vent line
(4) Loop vent (6) Relief vent pipes
3. Wall hung water closets
4. Horizontal vent pipes
5. Offset on vent lines
6. Connection for closet vents
7. Ventilators prohibited
a) Brick *c*) Earthenware flue
b) Sheet metal *d*) Chimney flue

I. Soldering nipples
1. Weight

4. Center to face
5. Face to face

6. Measuring offset pipe runs
A. Length of offsets
1. Length of any set for
a) 45 deg. *d*) 5⅝ deg.
b) 22½ deg. *e*) 30 deg.
c) 11¼ deg. *f*) 30 deg.
2. Length of rolling sets

7. Use of tables pertaining to plumbing installations
A. Terra cotta sewer pipe tables
B. Vertical galvanized range boilers, standard and extra heavy
C. Horizontal tank capacities and ratings, standard and extra heavy
D. Rectangular tank capacities and ratings
E. Round end stock tanks
F. Gallon per minute discharge of sewer pipes
1. Terra cotta
2. Cast iron
G. Boiling points of various fluids
H. Melting points of various metals
I. Weights and measures
1. Linear
2. Square
3. Cubic
4. Avoirdupois
5. Liquids
6. Square of numbers
7. Square root
J. United States standards for sheet metal
K. Drill and tap sizes
L. Amount of lead for cast iron pipe installation table, standard and extra heavy
M. Amount of oakum for cast iron pipe installation table, standard and extra heavy
N. Lead-in alloys
O. Sheet lead tables
P. Lead waste and service pipe tables
Q. Pressures
1. Head of water in feet with equivalent pressures
2. Water pressures in pounds with equivalent heads
3. Boiling points of water at various pressures
4. Water flow in pipes
R. Heater sizes and capacities

8. Elementary plumbing business arithmetic
A. Price list of material
1. Meeting code requirements
2. Grade or kind of material
3. Catalogue specifications
a) Trade name
b) Purpose
c) Cut or picture
d) Sizes, weights, dimensions
e) Roughing-in measurements
f) Gaining information from catalog
g) Use of catalog index
B. List price
C. Price quotations
D. Finding net price
E. Wholesalers' discounts
F. Applied percentage
G. Applied terms in percentage
H. Customers' discount

e) Raised rear vent applied to different types of water closet
(1) For floor elevation layout of toilet room ventilation by water closets having raised rear vents
f) Ventilation of toilet rooms through urinals
g) Plan view of toilet room ventilation through water closets and urinals
h) Circuit and loop venting for line of water closets on three floors
i) Layout for connecting refrigerator drains
j) Safe waste connections for drinking fountains
k) Safe waste connections for dental cuspidor
l) Waste connections for bars and soda fountains
m) Acid waste connections roughing-in
n) Piping roughing-in for blowoff or condensing tank
o) Tank overflow connections
p) Plan and elevation layout for garage drainage
q) Surface and catch basin drainage plan
r) Connections for frostproof water closets
s) Venting and drainage for fixtures located in the center of a room
t) Slop sink arrangements
u) Three-inch soil stack elevation for small dwelling
(1) Bathroom
(2) Kitchen
(3) Laundry
(4) With water closet in basement
v) Septic tank drainage layout
w) Air line piping with carbonated gas tank connections
x) Air intake arrangement from beverage pumps
2. Group fixture layouts
a) Toilet rooms
(1) Water closets
(2) Urinals
(3) Washstands
(4) Slop sink
b) Fixtures back to back
(1) Duplex dwelling bathroom group
(2) Urinals—water closets—washstands—slop sink combinations
c) Fixtures in a row
(1) Water closets
(2) Urinals
(3) Showers
(4) Washstands
(5) Slop sinks
(6) Fixture combinations
d) Bathroom combination layouts
(1) Water closet
(2) Bathtub
(3) Shower
(4) Washstand

6. Building ventilation and drainage—hot and cold supplies
A. Two story one family dwelling
B. Multiple dwellings
1. Duplex
a) Two story — two families
b) Two story — four families
c) One story — one family

(Continued on next page)

Trade terms, tools, materials, and science principles	Shop mathematics	Blueprint reading, drawing, and estimating
J. Brass cleanouts K. Diameter and weight of ferrules L. Fixture installation 1. Setting of fixtures 2. Closets prohibited 3. Water closet connection with soil pipe 4. Water closet, where located 5. Water closets, house supplied 6. Water closets to be supplied from flushing tank 7. Water closets for tenement houses 8. Number of closets required 9. Water closet apartments 10. Construction of urinals 11. Commercial or experimental installations 12. Fixtures prohibited 13. Yard water closets 14. Cesspools and privy vaults 15. Privy vaults in districts where no sewer exists M. Inspections 1. First inspection 2. Final test 3. Prosecutions 4. Penalties N. Duties of plumbing inspectors O. Fees for filing plan or plans P. Buildings used for public assemblages 1. Soda fountain 2. Lunch counter 3. Beer workboard 4. Size of trap and waste pipe 5. Toilet accommodations 6. Air intake from any beverage pump 7. Air lines with carbonated gas tank connections Q. Cross connections 1. Definition 2. City water supply line 3. Applications of	I. Discount series 1. Two or more discounts J. Pricing complete material list K. Calculating total material cost L. Calculating total labor cost M. Overhead cost 1. Salaries 2. Advertising 3. Legal expense 4. Taxes 5. Bad accounts 6. Nonproductive labor 7. Insurance 8. Rent 9. Depreciation 10. Damaged material 11. Tools 12. Miscellaneous shop expense 13. Calculating total costs N. Profits	C. Ventilation and drainage for 6-story building 1. Sanitary facilities D. Fourteen-story building 1. Sanitary facilities 7. Interpretation of specifications and contract documents A. City ordinances B. Codes 1. Building 2. Plumbing C. Contracts 1. Definitions 2. Drawings 3. Materials and equipment 4. Patented articles 5. Surveys 6. Property protection 7. Superintendence and inspection of work 8. Extra work 9. Defective workmanship and materials 10. Insurance 11. Liens 12. Assignments *a*) Subletting 13. Use of premises 14. Specifications 15. Bonds *a*) Bidders' *b*) Performance 8. Estimating for ventilating, drainage, supplies, and fixture installations A. Material "take-off" B. Labor costs C. Overhead D. Contingencies

Vocational Foundry and Patternmaking Course

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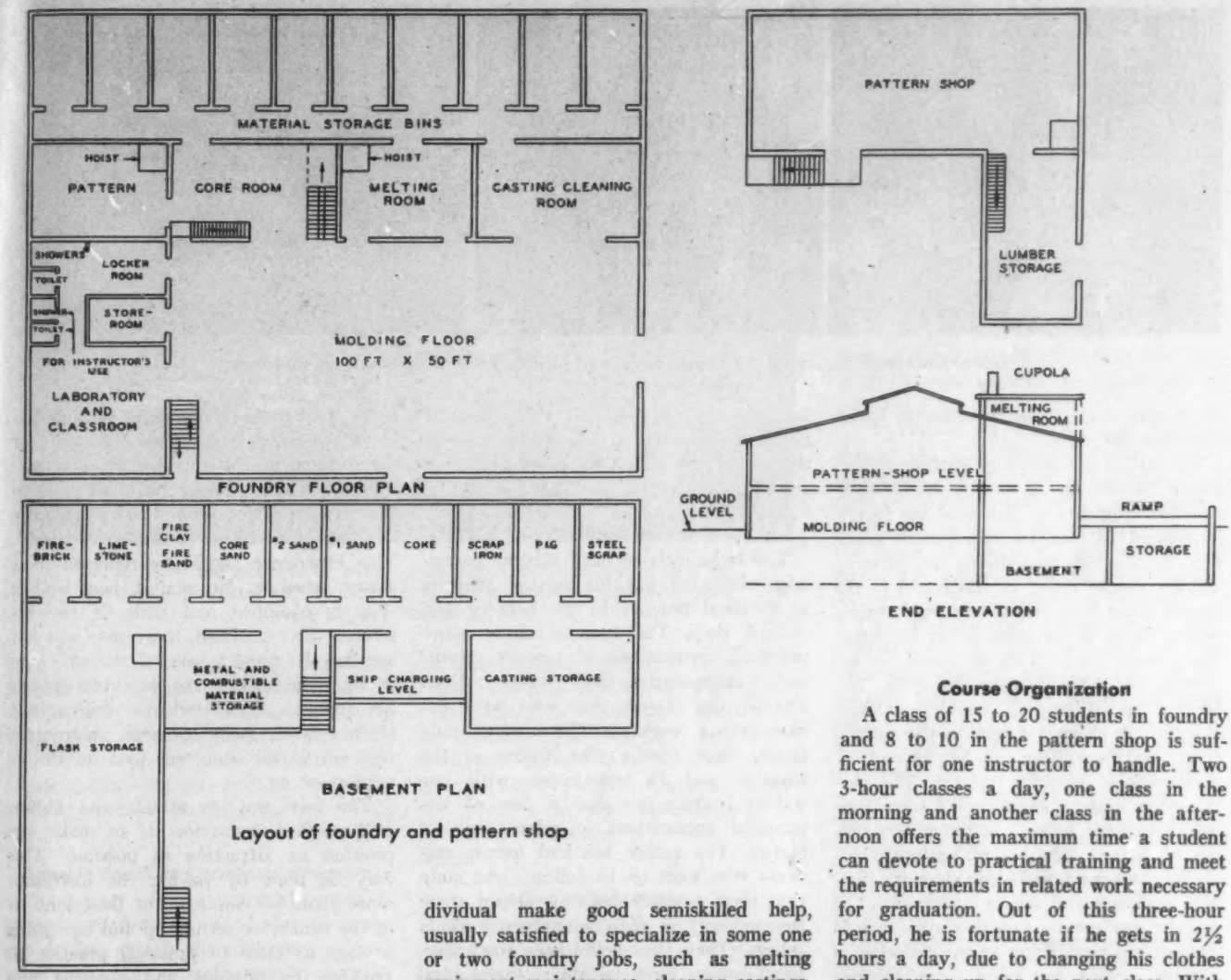
In no other school shop course is there a possibility for more diversified training, offered than in a foundry and pattern-shop course. The benefits derived can be threefold: (1) to offer a working knowledge of the production of castings so necessary to our everyday life in this machine age in which we live; (2) to offer practical application of related subject matter; (3) to lay a good sound foundation for a trade, a lifetime investment.

At no other time than now is there a greater demand for young blood in the foundry industry. The error of the belief that the foundry is a place for those with a strong back and a weak mind is proved by the caliber of individual the foundry industry is seeking today. The foundry industry has become a science, a science in which the diversified divisions must be exacting in order to meet the demands placed upon them. For example, strength, design, analysis, methods, and problems of producing and application of the castings called for, are but a few. Many requirements placed on the foundry industry during the war have resulted in new methods, application of new materials, better analysis, better working conditions, laborsaving devices, and, most of all, an urgent need of young foundrymen, technical, skilled, and semiskilled. The advancements made in the foundry industry warrant careful consideration in the selection of the type of individual best suited to train and most likely to succeed and progress.

An Introduction to the Foundry

Very little is known about the foundry industry by the general public. This is, no doubt, due to the fact that not very many people get an opportunity to visit a foundry. The author has been very much impressed by the wholehearted interest and surprise on the part of visitors as to the skills and knowledge required in the foundry and pattern shop to produce castings essential to present-day needs.

In order to get the caliber of student necessary to meet the foundry industry's needs for help, it is essential that people get a true picture of the industry and the possibilities it holds forth. Here is



Layout of foundry and pattern shop

where the foundry executive, foundry manager, or local Foundrymen's Chapter can be a big help in acquainting students, parents, and school administrators with the foundry industry. The former should make themselves available to speak at school assemblies; set up and take part in apprenticeship courses; aid, advise, and promote the schools' training program; and work with school administrators. Acquainting the school board's guidance staff with the personnel needs of the industry will greatly aid the counselors in their opportunity to introduce prospective students to the possibilities held forth by the industry, and to direct those most fitted toward it.

It has been a common belief that, if a student can't master subject matter or if he is a disciplinary problem, the place for him is in the school foundry. The sand pile is supposed to be a cure-all. Occasionally, some of these types of individual make good semiskilled help, usually satisfied to specialize in some one or two foundry jobs, such as melting equipment maintenance, cleaning castings, preparing sand, etc. The most difficult part in training this type of individual is keeping him in school long enough to train him sufficiently.

The training offered in a school foundry and pattern course is mostly individual instruction. Training those for the skilled positions along with those for the semiskilled aids all concerned. Having the brighter or more adept students help the slow-progress students aids both, in that the retarded student has an objective to strive for; the bright or more adept student gains the knowledge of leadership which tends to instill self-confidence in him. By training a mixed group, both elementary and advanced, the cycle from molding to pouring off and the pattern construction from blueprint to foundry is more efficiently and safely carried out. In this way, there is always a carry-over from term to term, leaving students to build on each term.

Course Organization

A class of 15 to 20 students in foundry and 8 to 10 in the pattern shop is sufficient for one instructor to handle. Two 3-hour classes a day, one class in the morning and another class in the afternoon offers the maximum time a student can devote to practical training and meet the requirements in related work necessary for graduation. Out of this three-hour period, he is fortunate if he gets in 2½ hours a day, due to changing his clothes and cleaning up for the next class. With other time-consuming activities taken out of shop time, the student averages about 12 hours per week, 38 weeks per year. The author is in favor of running one foundry and pattern class for five full days, while the other class is taking its necessary related work for an equal number of days. By alternating this way, more can be accomplished on both sides.

In order that a student in either foundry or patternmaking may really achieve anything, he first must have an incentive to urge him to put forth an effort. Next, he must possess ability. He must progress and must be stimulated from time to time either through competition, praise, criticism, or some reward for his progress. The longer a student remains in the course, the more proficient he should become. The instructor should make it a point to create repetition as much as possible wherever necessary. The more advanced student's ability should be

Left — Coremaking; center — bench molding; right — floor and machine molding

challenged at all times in order to make him more proficient.

No part of a foundry or pattern course should be set up on a 10- or 20-week schedule. Students in that time are barely introduced to foundry and pattern practice. A student specializing in pattern-making should begin in the foundry. He should spend from one to two terms there, depending on his progress before he enters the pattern shop. This is based on an average of 12 to 15 hours per week. The student specializing in foundry practice should have at least a term in the pattern shop, starting either in his second or third year of foundry training. The pattern-shop student, by spending some time in the foundry, gains a better understanding of pattern construction, pattern moldability, foundry terminology, foundry physics, and care and use of equipment. The foundry student, by spending some time in the pattern shop gains an appreciation of patterns, their construction, some blueprint reading, and a better understanding of the possibilities of molding various shaped patterns.

Students entering a vocational or technical high school should have had or be introduced to a general industrial-arts program. Here a number of diversified activities set up on a small scale offer an opportunity for the student to explore. Through proper observation and guidance, the student is able to select the trade or profession he wishes to follow. This eliminates the waste of time usually experienced on the part of the students and instructor in an attempt to find out what they want to do. In a good many cases, students fail to decide on a vocation even by the end of their senior year.

The foundry industry requires approximately 8000 hours of its apprentices, or 2000 hours per year. A student in school in 38 weeks can at best receive only 570 hours of appropriate foundry training. One can readily see that there is no room for waste of time on the part of the school student, if he expects to gain any training at all.

Practical Application

The technically inclined student has an opportunity to put his related subjects to practical practice in the foundry and pattern shop. The foundry offers many practical applications of physics, chemistry, mathematics, and science. Even English, the subject that most boys dislike, gets a workout. The use of trade terms, trade science, the history of the foundry and its association with our civilian culture are but a few of the practical applications of related subject matter. The author has had former students who went on to college, who state that their foundry training helped them tremendously in their laboratory work in college. They have never been sorry they spent some time in the foundry and pattern shop.

Choosing the Instructor

One of the first and most important prerequisites in setting up a foundry and patternmaking course is to get a well-qualified instructor, one with a certified trade background and with ability to impart knowledge to others. His years of practical on-the-job foundry and pattern-shop experience should be equivalent to the training which other teachers acquire in a four-year college or university course. This experience should be reflected in a salary schedule. No matter how well a shop is equipped and built, if the instructor isn't qualified, the course will not survive. It doesn't take a student long to find out whether the instructor knows his business. If a student's ability isn't challenged on every occasion, an instructor's life in the shop will soon be a very unpleasant one.

The best way to attract and obtain well-qualified instructors is to make the position as attractive as possible. This may be done by paying the instructor more than he can earn in the plant or at the bench, by setting up and equipping a shop as close to practical practice as possible, by advising and assisting him to acquire necessary college credits, by backing him in his associations with the trade, and by allowing him to judge and appraise possible trade or technical students according to standards which he has set up.

If a school foundry and pattern-shop

Machine molding and view of open molds for drill press

Students in the process of bench molding. Submitted by Harold W. Hershey, instructor of foundry and patternmaking, Paul Revere Trade School, Rochester, N. Y.

course is to be successful and serve the purpose for which it is intended, and if the product turned out is to be of any value, then the prime objective should be at all times to teach the subject as the course outline implies, and the instructor and the students should have time to do this.

Sample Practical Correlated Program

A program where a practical project is started and finished, correlating the various trades, affords the most interest and experience. For example, one or more of the following is started in the drafting department: vise, surface plate, lathe, drill press, punch press, variety saw, band saw, etc. After a short course in elementary drafting, students, under the guidance of a capable instructor, can and have designed parts for the various units. When their drawings are completed, they are sent to the machine shops, pattern shop, welding shop, or wherever the parts are to be produced. This automatically carries on the interest and learning cycle instead of stopping with just the drawings, patterns, or castings.

The other trade shops carry out their part in the sequence. The pattern-shop students make the patterns, the foundry makes the castings, and the machine shop machines them. The students are allowed to buy the finished articles at cost. In this manner, the whole program is as practical as the various instructors want to and are capable of making it. The objection on the part of some instructors to this program is that it requires too much individual instruction. This usually comes from the fellow who wants to do his teaching from back of a desk. When a student finishes in a program of this type, he should be well equipped, to enter and progress in his apprenticeship and eventually to become a valuable asset to industry.

Cost of Installations

For those interested in setting up and operating a practical foundry and patternmaking training program in a school, the approximate cost is a follows:

Foundry equipment — approximately $30,000. Pattern-shop equipment — approximately $15,000. This is based on machinery and equipment that will withstand the severe usage and wear that most beginning students are likely to give it.

As to the design and location of the building, this should be taken up with a committee of local foundrymen who understand the practicability of design and operation of a foundry and pattern shop. The person who is to be the instructor should be allowed to sit in on these committee meetings. The amount invested in such a course will be returned in the form of saving in casting and pattern cost in a very short time, not considering the wealth of training it affords for the tax dollar.

The Practicability of School Foundries

While an instructor in foundry and patternmaking practice in the city of Syracuse, N. Y., all the castings and some of the patterns for the school board maintenance of heating and operation equipment were made as a part of the foundry and patternmaking course. The average amount of iron melted per week amounted to approximately 1½ tons. Many former students of the course are now employed by the local industries of that city; while others after graduating from college entered the technical fields. Industries there were very much interested in the school training program. Some foundries and pattern shops allowed credit toward an approved apprenticeship program for a graduate of the school training program.

The course in foundry and patternmaking at the Revere Trade School, Rochester, N. Y., where the author is now employed as instructor, is conducted as closely to actual practical practice as the scope of the floor space and equipment will allow. The requirements for entrance to the course are as follows:

The foundry and pattern shop offer definite practical basic training for the beginner, correlated advanced training for the more advanced pupil, and special training for those wishing to specialize in any definite phase of foundry and pattern practice. Either course will serve the needs of the student planning on entering an engineering college or the student choosing to take up the work as a trade. The foundry will accommodate 20 students and the pattern shop will accommodate 10 students per class.

The foundry and pattern shop has 3000 square feet of floor space, including 1200 square feet of storage. The divisions of the foundry trade taught are bench, floor, and machine molding for both ferrous and nonferrous metals, core making, casting, grinding and cleaning; setting up, operation, and care of melting equipment; casting checking, rigging, and sand testing.

The foundry is equipped with all the necessary hand tools and equipment together with a No. 1 Whiting cupola with a skip hoist attached, a No. 35A Stewart crucible furnace, a Mahler automatic-controlled, heat-circulating core oven, and a Simpson and two Royer sand mullers. The molding equipment is comprised of eight bench molding spaces, two molding machines, one Adams jolt squeeze and one Osborn jolt squeeze. The floor molding ranges in flask sizes from 14 by 24 in., to 60 by 60 in. The cleaning equipment in the foundry consists of one large Whiting tumbling barrel, Sly sandblast cabinet, and a large 18-in. double wheel Marschke grinder, together with two each portable

air grinders and air chipping hammers. The latest addition to the foundry is the sand testing laboratory. This laboratory is equipped with the latest Dietert sand-testing equipment.

The pattern shop is equipped with a variety saw, 18-in. jointer, 24-in. planer, 36-in. band saw, Delta production drill press, Mummert Dixon oilstone grinder, wood-turning lathe, disk and spindle sander, flexible shaft grinder, and portable router. All the necessary hand pattern-making tools are available in suitable cabinets.

A student entering the pattern trade should be at least a first-year high school student, have at least a year of mechanical drawing, and should be required to take elementary and advanced machine design while taking the course. He should be able to do fractions and decimals and have some knowledge of geometry. He should also take a course in materials of industry. If the student specializes in patternmaking, he will be given from a term to a year of foundry practice in his three- or four-year course. This is based upon the number of hours he has completed in the course.

The requirements for the foundry course are that the pupil must be at least a first-year high school student, physically fit, weigh at least 140 pounds, be willing to work and follow orders, and not be afraid to get his hands dirty. A pupil in the foundry must possess or be able to develop a high degree of self-reliance. He should have at least one year of mechanical drawing and be able to read blueprints. A fourth-year student will be given a term of correlated patternmaking and a course in materials of industry. Training in metallurgy to fit the needs of the foundry will be given in the student's third or fourth year, depending on his science background.

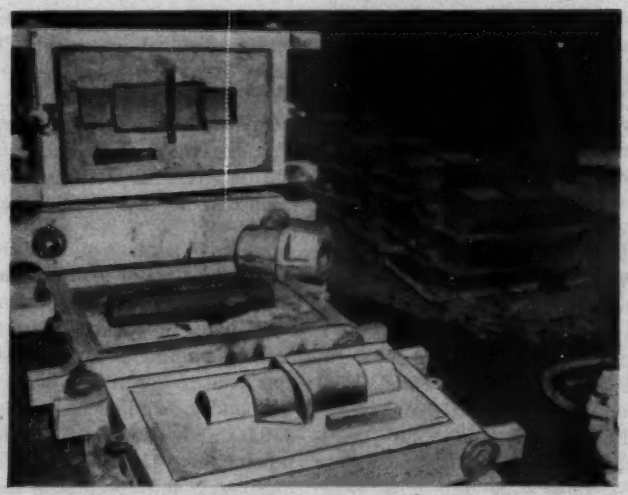
The foundry and pattern shop is operated as near as possible to industrial procedure in order to give the student a good all-round practical training. There is very little practice work. Nearly everything made has a utility value. All the machine shops in the school system are kept supplied with castings for various articles. Castings and patterns are made for the maintenance of the various schools in the city system. Students are allowed to progress as rapidly as their ability will permit. Some students are employed in foundries on a part-time basis.

There is a great need for young workers in both the foundry and patternmaking field today, especially for the young man with diversified training in either field. There are few skilled mechanics possessing this type of diversified training left in industry today to meet the needs of tomorrow.

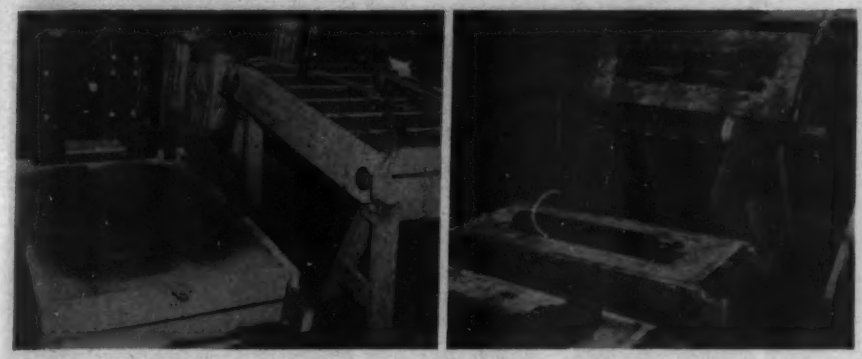
General Outline for Basic and Advanced Foundry Courses

NOTE: The course outlined is to be supplemented by guest speakers, moving pictures, and plant visitation.

1. *Intoduction*
   - A. History
   - B. Place and importance in metalworking field
   - C. Processing of casting metals from mine to foundry
   - D. Foundry products
     1. *Ferrous:* (*a*) cast iron, (*b*) gray iron, (*c*) white iron, (*d*) chilled iron, (*e*) malleable iron, (*f*) high test iron, (*g*) steel, (*h*) carbon alloys
     2. *Non ferrous:* (*a*) brass, (*b*) bronze, (*c*) aluminum bronze, (*d*) babbitt, (*e*) silicon bronze, (*f*) aluminum alloys, (*g*) monel, (*h*) magnesium, (*i*) solders, (*j*) fusible alloys
   - E. Divisions of foundry
     1. Supervision
     2. Metallurgist
     3. Pattern clerk
     4. Time checker
     5. Rigger
     6. Patternmakers
     7. Molders: (*a*) floor, (*b*) bench, (*c*) machine
     8. Coremakers
     9. Crane operator
     10. Molders' helpers
     11. Laborers
     12. Melters
     13. Furnace operators
     14. Shake-out gang
     15. Casting cleaners: (*a*) snaggers, (*b*) chippers, (*c*) blast machine operators
     16. Casting inspectors
2. *Foundry terminology*
3. *Foundry tools and equipment*
   - A. Hand: (1) care, (2) use
   - B. Machine: (1) care, (2) use
4. *Foundry flasks and rigging*
   - A. Care
   - B. Use
   - C. Sizes and shapes
   - D. Bottom boards and molding boards
   - E. Clamps and weights
   - F. Arbors
5. *Patterns*
   - A. Types: (1) loose, (2) gated, (3) boarded, (4) split, (5) cored, (6) sweeps
   - B. Color markings
   - C. Construction
   - D. Care
6. *Foundry sands (composition and physical)*
   - A. Molding: (1) grades, (2) uses, (3) methods of testing, (4) binders, (5) facings, (6) partings
   - B. Core: (1) grades, (2) uses, (3) methods of testing, (4) binders, (5) mixes
7. *Sand handling and processing*
   - A. Machine
   - B. Hand
8. *Sand testing*
   - A. Grade
   - B. Moisture content
   - C. Permeability
   - D. Green strength
   - E. Dry strength
   - F. Refractoriness
   - G. Microscope study
9. *Fundamental principles of molding*
   - A. Incorporation of tools and equipment to be used: (1) sizes and type of flasks to be used, (2) ramming, (3) venting, (4) gating, (5) risers, (6) chills, (7) reinforcing, (8) handling and floor planning, (9) shop symbols
10. *Sequential steps in molding course*
    - A. Flat back
    - B. Flat back with green sand core
    - C. Coping partings
    - D. Flat back with dry sand core



View of open mold with cores set



Open mold for machine table, and open mold with core

E. Split patterns
F. 3-part pattern (3-part flask)
G. Bedding-in
H. Printing back
I. Follow board (sand match)
J. Pattern with cover core
K. Pattern with tail prints
L. Pattern with loose pieces
M. Gated pattern
N. Boarded pattern
O. Molding with sweeps
P. Casting in core
Q. Pattern with number of cores requiring use of chaplets

11. *Machine molding*
A. Squeezers
B. Jolt squeezers
C. Jolt, roll-over, and stripper (description)
D. Sand slingers (description)

12. *Molding-in*
A. Green sand
B. Dry sand

13. *Melting equipment both ferrous and nonferrous (description)*

14. *Foundry fuels*
A. Coke
B. Oil
C. Gas
D. Electricity

15. *Cupola theory and operation*
A. Determining charge
B. Determining bed
C. Number of charges
D. Proportion of materials
E. Chemical reactions
F. Volumé of air
G. Air resistance
H. Temperature
I. Melting rate

16. *Refractories and fluxes*

17. *Nonferrous furnace operation*
A. Types of furnaces

18. *Metal handling*
A. Ladle lining and care of crucibles
B. Mold pouring: (1) principles involved, (2) skimmers and strainers, (3) gating according to shape and size, (4) gating to suit metal, (5) gates on patterns, (6) risers: (*a*) size and location, (*b*) feeding, (*c*) use of chills

19. *Coremaking*
A. Sand preparation: (1) mixes, (2) bonding
B. Sand handling
C. Types of cores
D. Core reinforcing
E. Core venting
F. Core coatings and pasting
G. Core drying
H. Core storage

20. *Casting cleaning*
A. Tumbling
B. Sandblasting
C. Chipping
D. Grinding

21. *Casting inspection*
A. Shrinks
B. Cracks
C. Surface texture
D. Blow holes
E. Rattails
F. Sand holes
G. Cold shuts
H. Cored holes
I. Mismatches

22. *Safety and good shop keeping*
A. Sanitation
B. First aid
C. Care of tools, equipment, and materials
D. Safety devices
E. Personal attitude and dress

23. *Elements of metallurgy*
A. Chemical properties: (1) sand, (2) metal
B. Physical properties: (1) sand, (2) metal

NOTE: The foregoing course is correlated with the drafting, pattern, and machine courses.

The advanced course in foundry should be supplemented with some correlated chemistry and physics.

Outline of Basic and Advanced Course in Patternmaking Correlated With the Foundry Course

1. *Introduction*
A. Historical
B. Importance of patternmaking in structural and mechanical fields

2. *Common materials used in patternmaking*

3. *Knowledge of mechanical drawing*

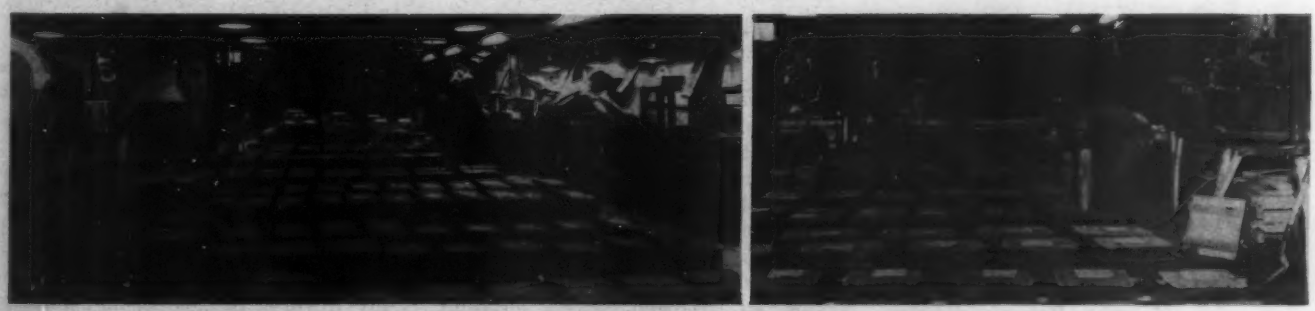
4. *Knowledge of geometrical construction* (figure fractions and decimals)

5. *Knowledge of lumber*
A. Kinds commonly used in construction of patterns
B. Characteristics of pattern lumber
C. Storage
D. Grades

6. *Common pattern joints*
A. Butt
B. Miter
C. End and cross lap
D. Dado
E. Rabbet
F. Tongue and groove
G. Butt and miter with spline
H. Various forms of dovetails

7. *Principal layout tools*
A. Knife
B. Square
C. Gauge
D. Shrink rules
E. Dividers
F. Bevel
G. Protractor
H. Scriber

8. *Pattern layout*
A. Shrinkage



Molding and setting up for pouring

Pouring molten iron into the ladle and pouring off bench molds

B. Direction of grain in respective pieces
C. Mechanical drawing symbols
D. Allowances for finish and draft
E. Allowances for core prints
F. Laying out center lines

9. *Use of patternmakers' vise*
10. *Pattern construction*
    A. Joinery
    B. Fitting
    C. Securing: (1) glue, (2) nails, (3) screws, (4) shellac
11. *Pattern-shop machines, their operation and care*
    A. Swing saw
    B. Circular saw
    C. Jointer
    D. Planer
    E. Band saw
    F. Sand (spindle and disk)
    G. Lathe
    H. Drill press
    I. Jig saw
    J. Portable router
    K. Tool grinder

NOTE: The safety involved in the operation of these machines is to be discussed and analyzed at the time of the lesson on each machine.

12. *Tool grinding*
    A. Knives
    B. Chisels
    C. Gouges
    D. Carving tools
    E. Bits
    F. Dividers
    G. Lathe turning tools
    H. Saw filing (machine and hand)
13. *Use of other hand patternmaking tools*
    A. Hammers
    B. Steel square
    C. Panel gauge
    D. Surface plate
    E. Surface gauge
    F. Triangles
    G. Trammel set
    H. Inside and outside calipers
    I. Planes (care and adjustment): (1) jointer plane, (2) jack plane, (3) block plane, (4) rabbet, (5) router, (6) core-box plane, (7) soled plane
    J. Brace
    K. Hand drill
    L. Screw drivers
    M. Drills
    N. Handsaws

During the war, the school foundry was called on to do its part. All the original kirksite dies for a blister ball turret on a fighter bomber were cast from plaster patterns for a local manufacturing concern. Some six tons of metal were cast in all to make these dies.

Forty sets of ordnance inspection training forms, each set weighing 1800 lb., were cast and shipped to the various training centers. Night molding and pattern-making classes were run. Full and part time workers were trained. At various times, two 3-ton heats of iron a week run. At present, the instruction in molding and the possible students available warrant one 2-ton heat of iron every two or three weeks. Some of the practical line of patterns and castings being made at present are: various types of vises, angle plates, replacements of broken machine parts, board of education maintenance parts, drill press, surface plates, checking fixtures, novelties, and stock pieces for various shapes for the machine shops. These are a few articles around which instruction is built.

Course Outline for Related Subjects in Carpentry

CARLTON DWIGHT
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Binghamton, N. Y.

The related subjects requirements in all approved apprentice training programs is the basic background for intelligent craftsmanship — competence for practical action. The training of routine mechanics is not enough. To know *how* is important, but competence implies a knowledge of *why* as well.

The primary objective of this course of study is to present the technical knowledge necessary for the apprentice to master in the carpentry trade if he is to become an all-round skilled mechanic rather than simply an ordinary hand.

The course of study is broad in its coverage of the related subject field, is not intended to be inflexible, and has been set up on a class of work or unit job basis to meet certain specific training problems. Some of the specific problems which it is felt this type of course organization will best meet are:

1. The training will be of most value to the apprentice if he is acquainted with all phases of related information in relation to a given type of work.

2. It is necessary that the related instruction be so organized that apprentices may enter the program at approximately the time they enter the trade. In the plan of organization for this course of study, it will be possible for an apprentice to enter the program at the beginning of

any given course. The only prerequisite for any course is the course entitled "Introduction and Basic Information."

This plan, then, makes possible class personnel changes at the beginning of any given course.

The preparation of this course of study was done by the staff of the Division of Vocational Education, Department of Education, Binghamton, N. Y., in co-operation with the joint apprenticeship committee representing the carpentry trade.

It is not assumed that this course of study is a finished project. It will require constant revision as defects become apparent through its use, and as changes occur within the trade. It does, however, give the teacher a definite starting point, a wide range of material to be covered within specific time limits, and a definite goal to work toward.

Curriculum

Course of Study — One-Year Division

Introduction and basic information
- I. Introduction
- II. Basic information

Concrete form construction

Construction of scaffolding and staging

Framing, sheathing, and insulation
- I. Sill, girder, and floor framing
- II. Side wall and sheathing
- III. Roof framing
- IV. Special framing problems
- V. House insulation

Exterior finishing
- I. Roofing
- II. Exterior trim
- III. Side wall covering

Interior finishing
- I. Plaster grounds
- II. Flooring
- III. Interior trim
- IV. Interior wall board

Building maintenance and repair
- I. Shoring, needling, underpinning, and bracing
- II. Repairing and remodeling existing buildings

Course of Study

Introduction and Basic Information

Time Period — This course is basic and it is essential that each apprentice cover this information at the time he enters the program. It will often require individual study on the part of the apprentice under the supervision of, and with the assistance of, the instructor.

Introduction

A. The carpentry trade
  1. General statement — description of trade
  2. Working conditions in the trade
  3. Opportunities in the trade
  4. Ethics of the trade
  5. Qualifications for employment — educational, physical, general

B. The apprentice program
  1. The value of the apprentice program
  2. The responsibilities of the apprentice
  3. The program of related instruction — hours required, subjects covered, where and when the class meets

Basic Information

A. Trade science — materials
  1. Metal fastenings
    a) Nails
      1) The meaning of the term "penny"
      2) Types and uses — common, finishing, casing, box, cut, roofing, staging, wire brads, flathead wire nails
      3) Sizes of nails and approximate numbers to the pound
    b) Wood screws
      1) Holding power of screws
      2) Types and uses — flat round and oval head, drive screw, Phillips head, screw eye, screw hooks, lag screw
      3) Size specification
    c) Miscellaneous
      1) Bolts — types and uses (carriage, machine, stove, toggle), size specification
      2) Expansion shields
  2. Coated abrasives — definition, kinds of abrasive materials, kinds of abrasives, types of coating, grading, sizes of abrasive papers
  3. The characteristics of steel used in saws

B. Trade mathematics
  1. System of measure used by the carpenter
  2. Common fractions and mixed numbers — addition, subtraction, multiplication, division
  3. Simple essentials of geometry — circles, angles, triangles
  4. Simple problems in board measure
    a) Use of steel square table

C. Tools and equipment
  1. Hand tools — types, specifications, uses and care
    a) Measuring tools — tapes (steel or woven), spring joint rules, folding rules, framing square
    b) Layout tools — layout lines, chalk line, straight edge, marking gauge, door butt gauge, scriber, dividers and compasses, trammel points, try square, combination square, sliding T bevel, angle dividers, pencil
    c) Testing tools — try square, framing square, sliding T bevel, spirit level, plumb bob, plumb rule, line level, builder's transit or leveling instrument (wood leveling rod and target, leveling stand and level sights, extension stick)
    d) Handsaws — crosscut saw, ripsaw, backsaw, coping saw, compass saw, keyhole saw, miter box and saw
    e) Planes — smooth, jack, jointer, block, and special planes (rabbet, router, universal, spokeshave, fiber board cutter
    f) Boring tools — bit brace, auger bit, bit gauge, Forstner bit, expansive bit, bit stock drill, square shank twist drills, countersink
    g) Hand drills — automatic drill (drill points), hand drill, straight shank twist drills
    h) edge cutting tools — claw hatchet, half hatchet, shingling hatchet, drawshave, jackknife, wood chisels, wood gouges — mallets
    i) Driving tools — claw hammer, nail sets, pinch bar, straight bar, screw drivers (ratchet screw driver, Phillips head screw driver, screw driver bits), wrenches (adjustable, alligator), pliers and bolt cutters, star drill
    j) Smoothing tools — scraper blade, hoe-type scraper, cabinet scraper, scraper plane, wood files and rasps, sanding blocks
    k) Edge tool sharpening equipment — hand tool grinders, bench power grinder, grinding wheel dresser, safety goggles
  2. Portable machines — types, specifications, uses and care
    a) Electric hand saws
    b) Semi-portable radial arm saws
    c) Electric power plane
    d) Electric drill
    e) Electric router and templets
    f) Lock mortiser
    g) Electric sanders

D. Trade processes
  1. Methods of jointing, setting, and filing hand saws, and fitting up circular saw blades
    a) Saw sharpening tools and equipment — saw set, saw clamp, saw vise, saw files, oilstone
  2. Sharpening edged cutting tools
    a) Special sharpening tools — burnisher, oil and slip stones
    b) Methods of sharpening — plane irons, scraper blades, chisels, gouges, hatchets, drawshave
  3. Methods of sharpening bits and drills

E. Safety and accident prevention
  1. Safety rules for the use of hand tools
  2. Safety rules for the use of portable machines

F. Test and Review

Course: Concrete Form Construction

Concrete Form Construction

A. Trade science
  1. Classes of trees — trees used for lumber
  2. Characteristics and appearance of wood — modullary or pith rays, annual rings, sapwood, heartwood
  3. General information about concrete form construction
  4. Cement
    a) Manufacture of cement
    b) Chemical action of cement
    c) Factors that determine the strength of concrete
    d) Proportioning materials
    e) Slump tests
    f) Aggregate tests
    g) Curing of concrete

h) Tempering concrete
i) Cold weather concrete work
1) Ingredients used to cause concrete to set up fast
2) Prevention of freezing
j) "Ready-mixed" concrete

5. Soil conditions encountered in foundation work
a) Soils suitable for good foundation footings
b) Soils unsuitable for good foundation footings
c) Precautions to be taken in locating footings

B. Trade mathematics
1. Simple problems in cubic measure
2. Problems in excavation
3. Problems in estimating the cubical contents of forms of various shapes and sizes
4. Problems in finding the size of footings to carry a given weight
5. Problems in estimating quantities of lumber and other materials for forms and the preparation of bills of material
6. Problems in laying out building lines
a) Purpose, erection, and bracing of batter boards
b) Proper use of layout square
c) Application of 6, 8, 10 principle of squaring
d) Cross checking with steel tape
7. Problems in establishing grades — by use of builder's level, by use of transit
8. Problems involving use of builder's handbooks

C. Trade information
1. Study of building code in relation to placement of building

D. Special tools, equipment, and materials
1. Stock sizes of lumber used in form construction
2. Tie rods, strap iron, and spreaders
3. Wedge tightener
4. Wire ties
5. Anchor bolts and sleeves
6. Metal forms — pans, stirrups, column clamps, and adjustable shores

E. Trade processes — description of, construction of forms, and influence of speed of pouring and methods of vibration on form construction:
1. Laying out and constructing templates
2. Concrete piers and wall footings
3. Concrete foundation walls and bulkheads
4. Openings in concrete walls
5. Forms for concrete steps
6. Forms for floor and sidewalk slabs
7. Forms or centers for arched openings
8. Special forms for fireproofing — metal column forms, beam sides and bottoms
9. Special forms for floor construction — metal pan construction, Johnson combination construction, wood panel construction
10. Special forms for cinder block and brick construction for sills, lintels, copings, pilasters, columns, and corner columns
11. Finished ornamental forms

F. Blueprint reading and sketching
1. Building construction prints
a) The language of industry — lines, signs, and symbols; visualization
b) Lines, signs, and symbols
c) Essentials of shape description
d) Essentials of size description
e) Sections
2. Problems in reading concrete form construction prints
a) Taking off dimensions and materials
3. Making *on the job* sketches of various types and methods of concrete form construction

G. Safety and accident prevention
1. Importance of taking care of minor cuts
2. Safety precautions for running a concrete mixer

(*To be continued*)

Revised Electrical Course for Junior-Senior High School

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West Fulton High School
Atlanta, Ga.

There are so many phases of electricity and its applications that it is impossible to cover even the major parts in the short period allotted to industrial-arts courses, and with the present facilities. For this reason it becomes a matter of selecting those things which will serve as a basis of future study for those who are interested and also serve the needs of the average person in his economic life. In addition, emphasis should be placed on vocational guidance, one of the major values of all industrial-arts courses.

Of necessity, this course must be essentially of an orientation nature, and present the basic laws of electricity and of magnetism.

1. To present the basic laws of electricity and magnetism.

2. To form a basis for future study in electricity and allied fields.

3. To give the average person some electrical training that will be of value to him in his daily living.

4. To furnish experiences suitable for occupational exploration and choice.

5. To give insight into major processes by which man transforms the material of nature into his own personal use.

Methods of Instruction

1. Lectures by the instructor.

2. Demonstrations and experiments conducted by the instructor or qualified members of the class.

3. Electrical jobs carried out through job sheet media.

4. Shop projects which bring out some important principle and may serve as nucleus for related study.

5. Notebook or term paper on some phase of electricity.

6. Motion pictures and other suitable audio-visual instruction.

Course Organization

The actual shop course shall be conducted in accordance with class size, organization, and facilities available. The divisions herein listed are not necessarily in the best instructional order but should serve merely as a guide to the instructor.

Magnets and Magnetism

1. Lectures and demonstration on magnetism
a) Theory
b) Laws
c) Definitions
1) Lines of force
2) Magnetic field
3) Flux
4) Poles
d) Related subjects, such as history, inventions, etc.
e) Magnetic and nonmagnetic materials

f) Uses
2. Relationship of electricity and magnetism
   a) Experiments which show that a magnetic field exists around any conductor carrying an electric current
   b) Devices which use electromagnets
3. Construction of an electric buzzer

Principles of Electricity

1. Lectures and demonstrations
   a) Accepted theory of magnetism
   b) Kinds of electricity
2. Static
   a) Definition
   b) Sources
   c) Uses
   d) Importance
3. Current
   a) Definition
   b) Sources
   c) Uses
   d) Related subjects, such as history, great inventions, inventors, etc.
4. Experiments with different types of batteries
   a) Simple cells
      1) Definition of a cell
      2) Definition of a battery
      3) Connection of cells — series and parallel
      4) Polarity
      5) Direction of current flow
      6) D.C. voltage
   b) Dry cells
      1) Construction
      2) How they work
      3) Uses
   c) Storage cells
      1) Construction
      2) How they work
      3) Uses
   d) Primary and secondary cells
      1) Definition

Conductors and Insulators

1. Conductors
   a) Definition
   b) Materials
   c) Resistance
      1) Definition
      2) Uses
      3) Advantages and disadvantages
2. Insulators
   a) Definition
   b) Materials
   c) Uses
3. Splicing conductors
   a) Types of splices
      1) Western Union
      2) Branch tap
      3) Rattail
   b) Making splices — job sheet procedure

Circuits

1. Introduction: Wiring jobs are designed to explain the parts of any wiring circuit and to give the student practice in wiring simple and complex wiring circuits which he may use in daily life.
2. Kinds of circuits
   a) Series — definition and uses
   b) Parallel — definition and uses
   c) Series-parallel — definition and uses
   d) Parallel series — definition and uses
   e) Behavior of voltage, current, and resistance in each of these circuits.
3. Wiring problems involving circuits
   a) Simple bell circuit using one bell and one control
   b) Two bells in parallel controlled from one control
   c) Simple household bell system
   d) Duplex bell system
   e) Return call system using two-point control
   f) Return call system using three-point control
   g) Return call system for three systems using two-point control
   h) Household bell system using a bell transformer as the source of power
   i) Wiring up an annunciator
   j) Two bells in series controlled from one position
   k) Extension bell system controlled from one point
   l) Extension bell system controlled from two points

Shop Projects

1. Making a simple buzzer
2. Construction of a hotplate
3. Repairing electrical appliances

Related Information

1. Generation and distribution of electricity
2. Safety rules
3. Occupational information
4. Electrical standards—the N.E.C. handbook
5. Other information

Electrical Work

Job 1. Make a Western Union Splice

Read instruction sheet, Job 1. Ask instructor for some scrap bell wire. Check out necessary tools. Show splice to instructor for approval. If satisfactory, hand in splice with written report of questions of Job 1.

Job 2. Make a Branch Tap Splice

Read instruction sheet, Job 2. Secure additional wire. Use same tools. Submit splice for approval. If O.K., hand in report on Job 2 with your splice.

Job 3. Make a Rattail Splice

Read instruction sheet, Job 3. Obtain two more pieces of bell wire. Use same tools, and make splice. Secure approval from instructor. Then hand in splice with your written report on Job 3.

Job 4. Make a Simple Signal Circuit

Read instruction sheet, Job 4. Ask your instructor to assign a co-worker on the wiring panel. Secure wiring board and necessary materials. Check out tools needed. Follow procedure outlined. Have wiring checked before testing. Hand in written report on Job 4.

Job 5. Make a Two-Point Control Circuit

Read instruction sheet, Job 5. Secure additional wire for branch tap splices. Follow procedure as outlined. Have wiring checked. Hand in report on Job 5.

Job 6. Make a Two Signal, Single Control Circuit

Read instruction sheet, Job 6. Follow procedure. Have the installation checked. Hand in report on Job 6.

Job 7. Make a Two Signal, Two Control Circuit

Read instruction sheet, Job 7. Follow the procedure outlined. Obtain additional wire needed. Have wiring checked. Hand in your report on Job 7.

Job 8. Make a Three-Wire Return Call System

Read instruction sheet, Job 8. Follow procedure as listed. Use previous wire and lengthen by use of the Western Union splice. Have wiring system checked before testing. Hand in your report on Job 8.

Sample Job Sheet

Job No. 2. Wire and Wire Splicing: Branch Tap or Tap Splices

Job Specifications: To make a branch tap or tap splice.

Job Application: Tap splices are necessary in many electrical jobs.

Material: Scrap No. 14 or No. 18 wire, solder, rubber and friction tape.

Tools: Knife, side-cutting pliers, soldering copper, gas furnace.

Procedure:

1. Remove insulation. From the piece of wire representing the main line wire remove the insulation for about 1 in. at the place where the tap is desired. From the tap or branch wire remove the insulation for a distance of 3 in.

2. Make the splice. Twist the end of the tap conductor around the main conductor as shown in Figure 1, making one open or neck turn and four or more end turns.

FIG. 1
TAP SPLICE

3. Solder the splice. Proceed as in Job 1, procedure 3.

4. Tape the splice. Follow rules and procedure as outlined in Job 1, procedure 4.

Questions on Job No. 2

1. What is the purpose of making one long turn (neck turn) in this splice?
2. What insulation is found on bell wire? House wire?
3. In branching off two main line wires at the same place, would the splices be over each other? Explain.
4. What insulation is found on flatiron cords? Why?
5. What are the main purposes of the insulation on a wire?
6. What is the primary use of the branch or tap splice?

Hand in your report and splice at the desk.

Course in Plastics

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Lucite and Plexiglas are undoubtedly the most versatile of all fabricating materials. They may be worked like wood, yet won't warp; worked like metal, yet won't tarnish. They may be cemented into a permanent joint; they can be shaped to any desired form, and can be dyed to any color. No other medium offers a better chance to apply creative design to such a high degree.

Working in plastics provides a basic yet general understanding of the processes and materials used in industry. The pleasure and relaxation acquired in the working of this substance provides worth-while leisure-time interest.

History

Contrary to belief, plastics are not new.

The first form of plastic was found in the middle of the nineteenth century, namely *Celluloid*, which was produced by the action of nitric acid on cotton cellulose.

In the beginning of the twentieth century *Bakelite* was evolved from sour milk and formaldehyde.

Classification

Today over 800 trade names are applied to plastics. Grouped according to chemical composition these break down into approximately 12 basic family types. All family types have peculiar characteristics just as aluminum and steel have different characteristics. These 12 basic family types fall into two groups, namely *thermosetting*, which take permanent form with the original application of heat and cannot be reformed, and *thermoplastics*, which can be formed under heat and assume a new form with each successive application of heat.

Lucite and Plexiglas, with which we work at Coopersburg, fall in the Acrylic family type and are of the thermoplastic group.

Plexiglas and Lucite, which to the best of my knowledge differ only in smell when being worked, are ideal materials for the home craftsman.

Six Major Processes

Sawing: Saws found in the home workshop are satisfactory for cutting plastic. Saws with little or no set are preferred. Table saws with a hollow ground blade are most suitable for straight line cutting. The problem of frictional heat must be kept in mind when using a power saw, since Lucite and Plexiglas are poor conductors of heat and are of the thermoplastic group. Plexiglas up to $\frac{1}{16}$ in. in thickness can easily be cut with a pair of scissors after stock has been heated to a pliable state.

Sanding and Buffing: A rough frosted edge is left after sawing. This edge can be made crystal clear by filing and dry sanding followed by wet sanding with 400 grit paper, then buffing. Loose muslin wheels, mounted on any grinding head or motor-driven shaft, can serve as a buffer. A touch of paraffin aids in holding the compound on the wheel. For the first buffing Tripoli does nicely to be followed with Learok No. s-28 for the final buffing.

The plastic must be kept moving while buffing so as not to burn or scorch it.

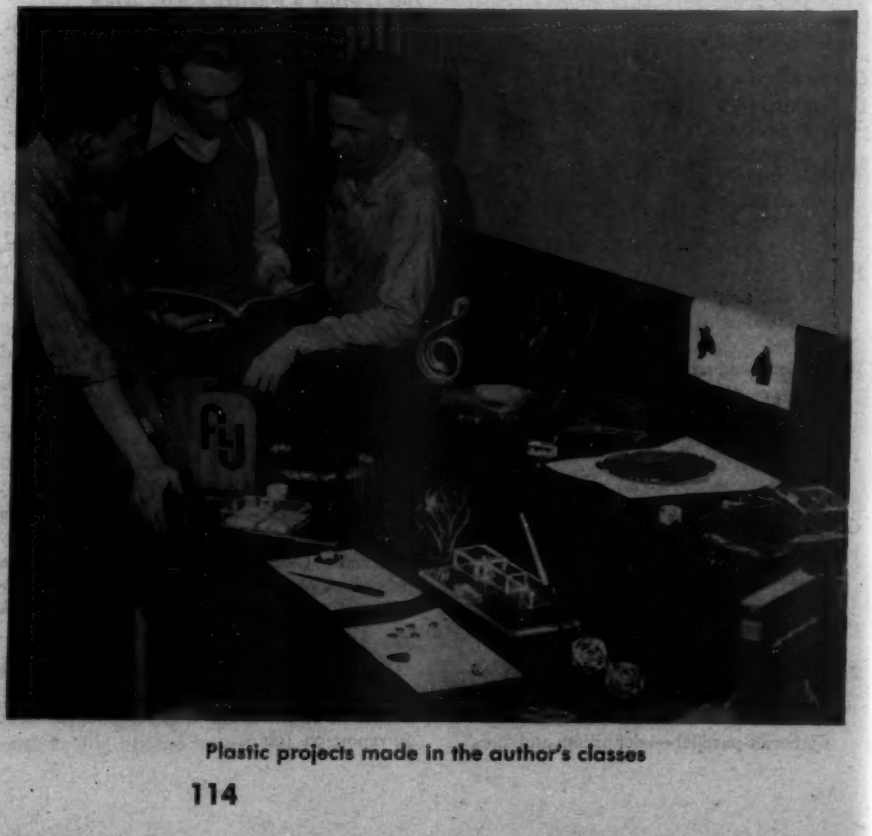
Soft flannel cloth may be used for hand polishing.

Water emulsion wax may be applied (by hand operation) to provide protection to the highly polished surface.

Heating and Forming: Heating in the home workshop can be accomplished in any kitchen oven. It is advisable to use an asbestos pad or mat upon which to lay the Plexiglas to avoid blistering. Preheat the oven 225 to 350 deg., depending upon the thickness of the stock. Remove the masking paper, place the plastic on the asbestos mat, and in a few minutes the plastic becomes *flabby* or pliable.

Unlike cast phenolic resin plastic, the acrylic family type of plastic should not be formed in hot water, since the temperature of boiling water is insufficient and may cause the surface of the plastic to become dull or even milky. The plastic, being pliable, is easy to form.

Cotton gloves should be worn to handle the hot plastic. Pinewood forms, covered with felt or flannel, serve ideally as jigs. The purpose of the felt or flannel is to protect the plastic from the roughness of the wood form. In the forming of a dish for example, a die and punch jig or form should be made. Speed in forming is a requisite, because the pliable plastic solidifies in a matter of minutes. Direct hand pressure on the punch form, or pressure derived from the use of drill press does the job nicely. Hold the plastic in the form until cold; when it hardens it will maintain



Plastic projects made in the author's classes

its new shape. Water may be poured on the plastic to speed up cooling.

Before placing the pliable plastic into the wood form, the plastic should be waved through the air to slightly harden the very outer face of the plastic. This is a precaution against *form offset.*

The happy feature about the thermoplastic group is that if the shape is not satisfactory with the first forming attempt, the material can be heated again and it will return to its original flat shape, after which forming can be attempted again.

Cementing: Like the gluing of wood, the cementing of plastic requires two perfectly flat surfaces. The side of an Aloxite Resenoid carborundum wheel mounted on a circular saw arbor provides a means of grinding a flat surface. If Du Pont's H-94 cement, sometimes called *Liquid Lucite,* is used the ground area need not be sanded and buffed since the dissolving action of the cement produces a clear transparent joint. Polished surfaces can be joined equally as well, provided they are true and flat. A precaution in the use of Du Pont H-94 cement — keep it in a cool or cold place (a refrigerator is ideal) since high temperatures or even warm weather causes it to harden to a solid piece of Lucite.

In cementing, it is advisable to apply cement only to one of the two areas to be joined. Two coats should be applied, especially when using Plastic Cement 1-C, allowing a few seconds drying period between coats. After applying the cement merely place the areas together, no clamps needed, and the two will fuse together.

In *face to face cementing* the application of a little heat, plus moderate pressure, forms an evenly cemented joint.

Another method of cementing is to *soak* the joint in cement. All surfaces, except those to be cemented, are masked with Cellophane tape, then immersed into the cement for a few minutes. A solid, permanent, transparent joint results.

Dissolving small shavings of Plexiglas or Lucite in the cement serves to increase the cohesive strength of the cement.

Dyeing: Excluding laminated dyeing, the process of dyeing is simple. Merely immerse the finished piece in plastic dye for a short time, depending upon the hue desired, remove, and wash thoroughly with water.

Dye may be brushed on if the piece is too large to dip or if only certain areas are to be colored. Dyeing is not an outer coloring, the entire piece absorbs the dye.

Dye may be used indefinitely, but straining the dye occasionally is recommended if it has been used over a long period of time.

Certain soluble dip dyes are sold in concentrated form. This type requires 10 parts water to 1 part dye. Heating the dye to approximately 190 deg. F. is necessary before immersing the plastic.

Laminating dyes are of another type and add new pleasure to dyeing. Take two pieces of plastic the same size, clean the faces of both with ordinary rubbing alcohol. Flood the cleaned faces with laminating dye, using a small water-color brush. Before flooding on the second coat of dye, allow the first to set for thirty seconds. Place the two pieces together *immediately* and press together for a minute or two. Allow this to dry from one to two hours, then sand and buff the edges. The result is one solid piece of plastic with the color inside.

By employing the same procedure and using two or more colors on the same face — sliding one piece over the other — results in blended colors.

Undercarving or Internal Cutting: This process is difficult to explain. It is the process whereby flowers, leaves, and other designs are carved into plastic stock. Using a tapered twist drill, power driven, and drilling up from the bottom side of the stock, moving the drill slightly from side to side will form floral petals and leaves. This is given the term *undercarving.* It is a comparatively simple process and yet adds much to the beauty of certain pieces. A frosted white design results. This may be colored by a drop of dye. A drop of water preceding the dye leaves a frosted edge around the flower or carving. A darker color dye over a light dye, for example red over yellow, yields a blended effect, which adds variety and beauty.

By employing the same procedure that would be followed for wood, plastic may be shaped and routed. Feed slowly and continuously.

Drilling may be done with regular twist drills that are used on metal. The lip angle should, however, be reground to 70 deg. to avoid grabbing. A thin soap solution serves as a lubricant. Avoid the use of auger bits in drilling plastic.

If tools are sharpened as for turning brass, Plexiglas and Lucite can be machined.

Plastics can be tapped or threaded with standard form. The coarser the thread, the better; fine threads are likely to shear. Either hand or machine methods may be employed.

Shoe Repair

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One of the finest of our old types of vocational training, and now probably the forgotten or most neglected member is that of cobbling or shoe repair. According to the latest information the only classes held in this subject are in our correctional and mental institutions. In a city as large as Boston there is no place where training in this field is given. We do not even see the usual apprenticeship of father and son going on and educators are letting a fine avenue of employment get away from them.

If the public school does not add this to their curriculum, then the time will come when this will have to be presented by the private trade school. A unit as necessary and as purposeful as this has a place in every school's curriculum.

The list of tools and materials that follow were supplied by the United Shoe Machinery Corporation of Boston and are set up in two lists.

The first list shows the tools and materials required for one boy in shoe repair without machines, for a total of $53.27. List No. 2 supplements this and extends its use to a whole class for an additional $28.04. This unit is priced for $81.31 in the current Boston market.

TOOLS AND MATERIALS FOR ONE BOY*

1	Jack JZS-153	$ 7.80
	This Jack comes with 6 lasts (No. 10M — 1.20 8N — .95 8M — 1.00 8W — .95 7N — .95 6M — .75)	
1	8 in. heel pincer	.70
1	Type A heel remover	.40
1	9 in. Crispin rasp	.45
1	No. 4 square point U.S.M.C. shoe knife	.30
1	No. 2 right-hand curved lip, U.S.M.C. shoe knife	.40
1	No. 3 knife sharpening stone	.55
1	No. 2 yellow label Crispin hammer ..	1.95
1	wood heel hammer	1.60
1	Cantrol nail set	.14
1	No. 2 star pegging awl haft, riveted ..	.31
½	doz. No. 2 New England pegging awls @ .45 doz.	.23
1	No. 2 arrow sewing awl haft, riveted	.30
½	doz. No. 8 New England sewing awls @ .75 doz.	.38

*Prices from United Shoe Machinery Corp., 140 Federal St., Boston, Mass.

1	No. 165 — 6 in. Bernard end cutting nippers	1.90
1	pkg. wire sewing bristles (pkg. of 12)	.90
1	cake black hand sewing wax @ .35 doz.	.03
1	cake brown hand sewing wax @ .35 doz.	.03
1	OED heel shave No. 5	1.80
1	Johnson edge shave (oval)	1.80
½	doz. sheets No. 40 9 by 11-in. carborundum metal cloth ALO — EC @ 10½c sheet	.63
½	doz. sheets No. 100 9 by 11-in. carborundum metal cloth ALO — EC @ 7½c sheet	.45
1	gal. Repco rubber cement	1.27
1	gal. black Repco ink	1.26
1	gal. brown Repco ink	1.26
1	1-in. cement brush	.25
1	1-in. blacking brush	.65
½	doz. 4-row wood-handle inking brushes	.70
1	qt. 5/8–11 Repco shoe pegs	.20
1	lb. KK Ex iron clinch nails 5/8 in.	.19
1	lb. 6/8–14 KK shoe nails	.15
1	lb. 5/8 KK soling nails	.17
1	lb. 2-oz. KK hand shoe tacks	.19
1	lb. 5/8–19 KK brad head wood heel toplift nails	.22
1	lb. 6/8–17 KK wood heel attaching nails	.18
1	lb. 7/8–13 KK wire rubber heel nails	.13
2	doz. branded men's leather half soles @ $3.75 per dozen pairs	7.50
2	doz. men's heels, $2 a dozen pairs	4.00
2	doz. women's soles, $3 a dozen pairs	6.00
2	strips women's heels, rubber lifts, @ $2 a 12 by 25-in. strip	4.00
2	balls hand thread (2-oz. ball) @ .45 per ball	.90
2	lb. pieces of branded leather @ .50 per lb.	1.00
	Total cost of tools and materials for one boy	$53.27

Additional tools to cover class of 12 to 16 boys or trainees. In adding these tools to the original list we can extend the activity to a whole class:

1	jack JZS-153	$ 7.80
1	8-in. heel pincer	.70
3	9-in. Crispin rasp @ .45	1.35
2	Type A heel removers @ .40	.80
2	No. 4 sq. point U.S.M.C. shoe knife @ .30	.60
2	No. 2 right hand curved lip U.S.M.C. shoe knife @ .40	.80
1	No. 2 yellow label Crispin hammer	1.95
1	wood heel hammer	1.60
2	Cantrol nail sets @ .14	.28
½	doz. No. 2 New England pegging awls @ .45 doz.	.23
½	doz. No. 8 New England sewing awls @ .75 doz.	.38
1	No. 165 6-in. Bernard end cutting nippers	1.90
1	pkg. of 12 wire sewing bristles	.90
3	cakes black hand sewing wax @ .03	.09
3	cakes brown hand sewing wax @ .03	.09
1	OED heel shave No. 5	1.80
1	Johnson edge shave (oval)	1.80
3	1-in. cement brushes @ .25	.75
3	1-in. blacking brushes @ .65	1.95
1	qt. 5/8–11 Repco shoe pegs, qt.	.20
2	lb. KK Ex iron clinch nails, 5/8	.38
3	lb. 5/8 KK soling nails	.51
3	lb. 6/8–14 KK shoe nails	.45
3	lb. 2-oz. KK hand shoe tacks	.57
2	lb. 5/8–19 KK brad head wood heel toplift nails	.44
2	lb. 6/8–17 KK wood heel attaching nails	.36
2	lb. 7/8–13 KK wire rubber heel nails	.26

A total of $28.04 for additional tools and materials.

Suggested Steps for a Course in Shoe Repair

Sole Repair: preparing the sole, preparing the shoe, cementing the sole, stitching (hand or machine), finishing.

Heel Repairing: attaching rubber heels, repairing men's leather heels, leather top lifts on women's shoes, attaching new wood heels.

Bottom Filler

Upper Repairing: the cement method, repairing by patching machine.

Lining and Stretching: heel lining, toe lining, replacing sock linings, stretching shoes.

Finishing: cleaning and shining, dyeing shoes.

Treatment of Sole Leather

Shoe Plates

Shoemaking Threads

Composition and Fiberized Soles

Heels: rubber, built-up, wood.

The Care of Shoes

How to Tie Shoe Laces

These suggestions for steps or operations were taken from: *The Shoe Repairers' Manual* by Robert Sieburth, published by the Gill Publications, Inc., 146 Summer St., Boston, Mass.; *Shoe Repairing* by Henry Karg, The Bruce Publishing Co., Milwaukee, Wis., $2.50.

Vocational Radio Instruction for Adult Classes

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The vocational radio instruction described here is for an evening school adult class which may also contain out-of-school youth. The course outline is also applicable to veterans' training classes. It is intended for training mechanics in the radio field. It covers construction, test, maintenance, and repair of radio sets and equipment. The length of time to be spent by an individual will depend on his past training, ability, interest, effort, and determination. For class meetings which are held at least two evenings per week of three hours each, the length of time may range from one to four years.

Evening school learners being greatly motivated, attend because of their own free will; therefore, the instructor is expected to have a broad experience, and to meet the learners' immediate needs. A great range of intelligence, age, experiences, knowledge, abilities, and interests are usually found in evening adult classes. This will therefore necessitate individualized instruction. To some applicants the field is entirely new, and some work in various radio industries and want to further their knowledge or understanding of their work. For those who have not had a previous knowledge of electricity, the new field may be found to be a difficult one. It is with these, that greater effort will be required, both by the learner and instructor.

A sympathetic understanding of the learners' problems, helping them to maintain interest in their work, and a personal and friendly attitude on the part of the instructor are of paramount importance in helping to be a successful adult school instructor.

The radio shop should provide facilities with which the various levels of learning can take place. It should contain up-to-date material and equipment which are of the best.

Instructional Methods

Where the school is large and the number of applicants warrant the creation of more than one radio class, the learners may be segregated in different level classes. The number of learners in a shop class should not exceed 25, as experience has shown that efficiency decreases above that number. While individualized instruction will still have to be provided in different level classes, the number of different jobs and work units going on at one time will be reduced.

The only practical and efficient method of instruction for a variety of jobs and

instruction units going on all at one time, is by the use of instruction sheets. They may be in the form of job sheets, information sheets, operation sheets, assignment sheets, problem sheets, and test sheets. A learner progress chart should be displayed on the bulletin board which will list the jobs or work units, and also show the quantity and quality of the learners' work.

While most of the instructional work is to be given by instruction sheets, assembled classroom instruction and discussion of learners' problems should also be included. It should be added when it is best suited to the needs of the class. Demonstrations, and the use of visual and sensory techniques will greatly aid in classroom instruction. Plain lecturing will generally not prove of interest to the majority of learners, and therefore should be avoided as much as possible.

Radio theory may also be given by information sheets and assignment sheets, in which case, reference to an appropriate book should be included. An occasional trip to industrial establishments is very helpful in learning and maintaining interest and is generally eagerly attended.

When learners are more advanced, they may be allowed to bring in radio sets for repairs, provided it is treated as an instructional unit and properly reported on a standard form which is to be used for such purposes. Material needed in such cases should preferably be purchased or brought in by the learner. Beginners should be discouraged from bringing in radio sets to the school shop, as experience has shown that too much of the instructor's attention is required and the beginner gets little instructional value out of it.

Instruction Sheets

Instruction sheets should be written in a clear, simple and concise language. They should be illustrated as much as possible with sketches and diagrams. They should not be too verbose, as that causes learners to waste time, and tends to decrease their interest. They should be mimeographed or hectographed on 8½ by 11-in. sheets, so as to be readily inserted in a standard loose-leaf notebook. Instruction sheets should include questions; written answers should be submitted by the learners.

The initial task of writing instruction sheets by the instructor for an entire course is a very tiring task and requires a great deal of time and effort. Fortunately there are on the market job sheets in manual form which while they may not always be the best for a particular situation, they may be used as is, or with modifications while the instructor is preparing his own. A list is supplied in the bibliography on this article.

When an instruction sheet is given to a learner, he should be told to read it carefully, and ask questions if necessary, in order to understand it thoroughly before commencing the work. The instructor should supervise the work so that the learner may derive the greatest benefit from its use.

Course Outline

Instructional units in the course outline may not all be needed or necessary for every learner, nevertheless, any or all units should be available when conditions demand them. A learner should be started with a unit of instruction of his level. This may be found by the first interview, and by a test which should be given at the first class meeting. Units of instruction which are needed for helping the learners should be given, rather than follow the numerical sequence of the outline.

The course outline should serve as a guide; revisions may be made from time to time as experience dictates.

At the first meeting of the class the instructor should collect personal information from the applicants, to enable him to evaluate the various degrees of abilities present. The first meeting should disclose the following:

a) Applicants' radio experience, present employment, and reasons for taking the course.

b) An exploratory written objective test.

c) Description of shop procedures.

d) Information on books to be used.

Theory Outline

1. *Electron theory:* (*a*) particles — electron, proton, neutron, etc., (*b*) structure of matter — similar to solar system, (*c*) electrical charges — like, unlike

2. *Electric currents:* (*a*) electron drift, (*b*) conductors and insulators, (c) basic methods of producing and utilizing electricity, (*d*) electrical units — coulomb, ampere, volt, ohm, watt

3. *Electric circuits and characteristics:* (*a*) series, (*b*) parallel, (*c*) series-parallel

4. *Electrical measuring instruments:* (*a*) voltmeter, millivoltmeter, (*b*) ammeter, milliammeter, microammeter, (*c*) ohmmeter, wheatstone bridge, (*d*) multimeter, (*e*) wattmeter, (*f*) tube tester, (*g*) capacity checker, (*h*) L.C. checker

5. *Magnetism:* (*a*) theory of magnetism, (*b*) magnetic fields and laws of magnetic poles, (*c*) permanent and temporary magnets

6. *Electromagnetism:* (*a*) right-hand rule for a single conductor, (*b*) right-hand rule for a coil, (*c*) electromagnets, (*d*) Lenz's law.

7. *Batteries:* (*a*) dry cell, (*b*) storage battery — lead, Edison type

8. *Mechanical generation of electric currents:* (*a*) Fleming's rule, (*b*) d.c. generators — shunt, series, compound, (*c*) a.c. generator — single phase, polyphase

9. *Sine waves of voltages and currents:* (*a*) effective, average, peak values

10. *Resistance and resistor:* (*a*) units — ohm, megohm. Wattage ratings, (*b*) carbon resistors, R.M.A. code, (*c*) wire wound resistors, rheostats, (*d*) volume controls, (*e*) carbon — negative coefficient of resistance, (*f*) metals — positive coefficient of resistance, (*g*) effects of wire length, (*h*) effects of wire diameter, area, (*i*) resistors in series, parallel, series-parallel

11. *Inductance and transformers:* (*a*) units — henry, millihenry, microhenry, (*b*) inductors in series, parallel, series-parallel, (*c*) noninductive windings, (*d*) self-inductance, (*e*) mutual inductance, (*f*) transformer construction and operation, (*g*) power transformers, (*h*) audio transformers, (*i*) R.F. coils, Q of coils, (*j*) iron-dust-core coils, I.F. coils, (*k*) choke coils

12. *Capacitance and capacitors:* (*a*) dielectrics, (*b*) unit — farad, microfarad, micromicrofarad, (*c*) area of plates, number of plates, spacing, (*d*) capacitors in series, parallel, series-parallel, (*e*) working voltage, peak voltage, breakdown voltage, (*f*) capacitor losses — leakage, absorption, dielectric, hysteresis, power factor, Q

13. *Capacitor types and construction:* (*a*) paper tubulars — wax impregnated, oil impregnated, (*b*) mica, (*c*) variable air capacitors (tuning condensers), (*d*) ceramic, (*e*) electrolytic — wet, paste type

14. *Diagrams:* (*a*) symbols, (*b*) schematic, (*c*) picture diagrams, installation, one-line, block, (*d*) tube base pin connections

15. *A.c. circuits:* (*a*) vectors, (*b*) inductive reactance, (*c*) capacitive reactance, (*d*) impedance — series, parallel, (*e*) resonance — series, parallel

16. *Oscillatory circuits:* (*a*) principles of tuning, (*b*) effects of resistance, selectivity, (*c*) distributed capacity, (*d*) losses — Q, (*e*) resonance curves

17. *Historic review of radio communications:* (*a*) early types of electromagnetic wave production, (*b*) types of radio waves and frequency bands

18. *Antennas:* (*a*) theory of radio waves — ether, quantum, (*b*) production of waves by antenna, (*c*) function of receiving antenna, (*d*) function of ground connection

19. *Vacuum tube principles:* (*a*) thermonic emission, (*b*) diodes, (*c*) triodes, (*d*) pentodes

20. *Vacuum tube constants and characteristics:* (*a*) amplification factor, (*b*) plate impedance, plate resistance, (*c*) mutual conductance (transconductance), (*d*) grid voltage — plate current curves. (*e*) plate voltage — plate current curves

21. *Power supply:* (*a*) half wave, full wave, (*b*) voltage doublers

22. *Detectors (demodulators):* (*a*) crystal detector, (*b*) diode detectors, (*c*) grid leak-grid condenser types, (*d*) power detection

23. *Audio amplifiers:* (*a*) transformer types, (*b*) resistance types, (*c*) impedance types, (*d*) Class A, B, C, (*e*) single, push-pull types,

(*f*) phase inversion, (*g*) inverse feed back, (*h*) voltage and power amplifiers, (*i*) decibel system.

24. *Radio frequency amplifiers:* (*a*) tuned (T.R.F.), (*b*) I.F. amplifiers, (*c*) wave traps

25. *Oscillators:* (*a*) Hartley, (*b*) Colpitts, (*c*) tuned-plate tuned-grid, (*d*) Meissner, (*e*) dynatron, (*f*) crystal, (*g*) electron-coupled

26. *Tune radio frequency T.R.F. circuits:* (*a*) neutralization of T.R.F. — triode receivers, (*b*) nonregenerative—tetrode and pentode sets

27. *Special circuits:* (*a*) automatic volume control (A.V.C.), (*b*) automatic frequency control (A.F.C.), (*c*) noise suppression circuits, (*d*) band-spread arrangements

28. *Superheterodynes:* (*a*) block diagram, (*b*) function of oscillator, (*c*) I.F. amplifiers, (*d*) first detector (mixer, converter), (*e*) beat frequency calculations, (*f*) "image frequency" suppression, (*g*) preselector circuits, (*h*) sweep signal oscillator, (*i*) vacuum tube voltmeter (NOTE: use of any equipment to be introduced as need arises)

29. *Measurements:* (*a*) sensitivity, (*b*) selectivity, (*c*) fidelity, (*d*) hum, (*e*) R.F. and A.F. voltage and current, (*f*) audio amplifier power output, (*g*) distortion

30. *Frequency modulation receivers:* (*a*) Comparison of amplitude and frequency modulation, (*b*) limiter, (*c*) slope filter, (*d*) F.M. detectors

31. *Amplitude modulation transmitters:* (*a*) oscillators, (*b*) buffer amplifiers, (*c*) speech amplifiers, (*d*) modulators: Heising system, plate, control grid, suppressor grid, (*e*) modulation adjustments, (*f*) control-room equipment, (*g*) testing and adjustments

32. *Frequency modulation transmitters:* (*a*) Armstrong circuit, (*b*) Crosby circuit, (*c*) testing and adjustments

33. *Special radio equipment:* (*a*) marine transmitters, (*b*) marine receivers, (*c*) aircraft transmitters, (*d*) aircraft receivers, (*e*) radio direction finders, (*f*) automatic alarm systems, (*g*) portable transmitters and receivers

34. *Microwaves:* (*a*) characteristics of microwaves, (*b*) cavity resonators, (*c*) wave guides, (*d*) magnetron oscillators, (*e*) klystron oscillator, (*f*) paraboloid antennas, (*g*) ionization of gases with microwaves

List of Jobs

1. Making wire connections
2. Soldering operations
3. Use and care of basic tools
4. Sharpening drills and drilling operations
5. Recognition and use of common screws, nuts, and other hardware
6. Lacing wire
7. Wiring a small chassis
8. Continuity checking of simple circuits
9. Salvaging parts of equipment
10. Use of ohmmeter and R.M.A. color code
11. Use of the multimeter
12. Making electromagnets
13. Remagnetizing small permanent magnets
14. Measuring resistance with the Wheatstone Bridge
15. Plot graph of Ohm's law
16. Test for characteristics of series circuit
17. Test for characteristics of parallel circuit
18. Test for characteristics of series-parallel circuit
19. Constructing a voltmeter
20. Constructing an ohmmeter
21. Building a small transformer
22. Test effects of magnetic induction
23. Winding coils and use of wire tables
24. Building a wave meter
25. Use of R.F. signal generator and calibration of wave meter
26. Building a crystal receiver
27. Use of capacitor tester and capacity measurements
28. Use of tube testers and testing of tubes
29. Building a one-tube regenerative detector
30. Comparison of a.c. and d.c.
31. Measuring inductance at low frequency
32. Testing resistors for nature of defect
33. Testing capacitors for nature of defect
34. Testing coils and chokes for nature of defect
35. Power supply construction
36. Use of oscilloscope and testing of power supply
37. Construction of audio amplifier
38. Use of beat frequency oscillator (B.F.O.) and test of audio amplifier
39. Plotting R.F. resonance curves
40. Measuring resistance at radio frequency
41. Measuring capacitance at radio frequency
42. Measuring inductance at radio frequency
43. Rectification characteristics of crystals
44. Rectification characteristics of diode tubes
45. EG — IP characteristics of triodes
46. EG — IP characteristics of tetrodes
47. Eg — Ip characteristics of pentodes
48. Ep — Ip characteristics of triodes
49. Ep — Ip characteristics of tetrodes
50. Ep — Ip characteristics of pentodes
51. Amplification factor measurements of vacuum tubes
52. Plate resistance measurements of vacuum tubes
53. Transconductance (mutual conductance) measurements of vacuum tubes
54. Construction of a.c.-d.c. 4-tube T.R.F. set
55. Test and alignment of a.c.-d.c. 4-tube T.R.F. set
56. Construction and test of Hartley oscillator
57. Construction and test of Colpitts oscillator
58. Construction and test of electron-coupled oscillator
59. Construction and test of quartz-crystal oscillator
60. Construction and test of dynatron oscillator
61. Construction of a.c.-d.c. 5-tube superheterodyne set
62. Test and alignment of a.c.-d.c. 5-tube superheterodyne set
63. Construction of a.c. superheterodyne with A.V.C. and phase inversion audio stage
64. Alignment methods of superheterodyne sets
65. Shoot trouble in superheterodyne power supply
66. Shoot trouble in R.F. stage of superhet
67. Shoot trouble in oscillator and mixer stage of superhet
68. Shoot trouble in I.F. stage of superhet
69. Shoot trouble in demodulator (detector) stage of superhet
70. Shoot trouble in A.V.C. circuit of superhet
71. Shoot trouble in A.F. stage and speaker of superhet
72. Shoot trouble in inverse feedback circuit
73. Shoot trouble in vibrator type power supply
74. Frequency response and power output test of audio amplifier
75. Sensitivity measurement of radio receivers
76. Selectivity measurement of radio receivers
77. Fidelity measurement of radio receivers
78. A.c. hum measurement of radio receivers
79. Image ratio measurement of radio receivers
80. Testing characteristics of frequency modulation (F.M.) R.F. amplifier circuit of receiver
81. Testing characteristics of F.M. oscillator and mixer circuits
82. Testing characteristics of F.M. I.F. amplifier circuit
83. Testing characteristics of F.M. detector circuit
84. Testing characteristics of F.M. limiter circuit
85. Testing characteristics of F.M. discriminator circuit
86. Testing of audio, speaker, and power supply of F.M. set
87. Alignment of F.M. receiver
88. Trouble shooting F.M. receiver
89. Testing characteristics of amplitude modulation (A.M.) transmitter oscillator circuit
90. Testing characteristics of buffer amplifier in A.M. transmitter
91. Testing characteristics of speech amplifier in A.M. transmitter
92. Testing characteristics of modulator in A.M. transmitter
93. Testing characteristics of R.F. amplifier in A.M. transmitter
94. Adjustments of A.M. transmitter
95. Trouble shooting A.M. transmitter
96. Measurement of antenna constants of transmitter
97. Measurement of power output of transmitter
98. Measurement of per-cent modulation in A.M. transmitter
99. Measurement of harmonics output in A.M. transmitter
100. Wavelength measurement with Lecher wires

Job sheets for F.M. transmitters and microwaves are to be developed and added as the need for them arises.

Evaluation of Results

Skills may best be evaluated by observing the learner. Knowledge may be evaluated as the jobs proceed, by oral questioning, by written answers to in-

struction sheet questions, and by periodic written tests.

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A thinking driver doesn't drink,
A drinking driver doesn't think. —
National Safety Council.

General Shop Personnel Organization

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In industrial-arts classes, personnel organizations can give students an active part in shop management. This activity will offer a more democratic form of experience and will give broader training. Assignment procedure, functions, the plan and its activities might be studied in detail by the student. With such study, pupils will become more active and more fully realize benefits.

The plan outlined here is designed for a four activity general shop. The basic principles, however, are flexible enough to be used in other situations.

Method of Assignment

One method of assignment, as illustrated here, is made up of four basic blocks of letters. Each block is six letters high and six letters wide. One of these blocks is composed of the first six letters of the alphabet. These are arranged in order on the beginning line. On each successive line, the first letter is omitted and included at the end. Other base blocks are made up of six letter groups following through the alphabet. The same system of arranging letters is used. All of these blocks appear opposite each subject division but are arranged in a different order. With this arrangement, assignment of 24 students to one of four subject groups and to one of 24 specific duties for one twenty-fourth of the year, is accomplished.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		ASSIGNMENTS
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	ELECTRICITY	GROUP LEADER
B	C	D	E	F	A	H	I	J	K	L	G	N	O	P	Q	R	M	T	U	V	W	X	S		TOOLS
C	D	E	F	A	B	I	J	K	L	G	H	O	P	Q	R	M	N	U	V	W	X	S	T		EQUIPMENT
D	E	F	A	B	C	J	K	L	G	H	I	P	Q	R	M	N	O	V	W	X	S	T	U		TABLES
E	F	A	B	C	D	K	L	G	H	I	J	Q	R	M	N	O	P	W	X	S	T	U	V		AREA SWEEPER
F	A	B	C	D	E	L	G	H	I	J	K	R	M	N	O	P	Q	X	S	T	U	V	W		SAFETY ENG.
G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	A	B	C	D	E	F	METALS	GROUP LEADER
H	I	J	K	L	G	N	O	P	Q	R	M	T	U	V	W	X	S	B	C	D	E	F	A		TOOLS
I	J	K	L	G	H	O	P	Q	R	M	N	U	V	W	X	S	T	C	D	E	F	A	B		BENCHES
J	K	L	G	H	I	P	Q	R	M	N	O	V	W	X	S	T	U	D	E	F	A	B	C		MATERIALS
K	L	G	H	I	J	Q	R	M	N	O	P	W	X	S	T	U	V	E	F	A	B	C	D		AREA SWEEPER
L	G	H	I	J	K	R	M	N	O	P	Q	X	S	T	U	V	W	F	A	B	C	D	E		MACHINES
M	N	O	P	Q	R	S	T	U	V	W	X	A	B	C	D	E	F	G	H	I	J	K	L	WOOD	GROUP LEADER
N	O	P	Q	R	M	T	U	V	W	X	S	B	C	D	E	F	A	H	I	J	K	L	G		TOOLS
O	P	Q	R	M	N	U	V	W	X	S	T	C	D	E	F	A	B	I	J	K	L	G	H		BENCHES
P	Q	R	M	N	O	V	W	X	S	T	U	D	E	F	A	B	C	J	K	L	G	H	I		MATERIALS
Q	R	M	N	O	P	W	X	S	T	U	V	E	F	A	B	C	D	K	L	G	H	I	J		AREA SWEEPER
R	M	N	O	P	Q	X	S	T	U	V	W	F	A	B	C	D	E	L	G	H	I	J	K		MACHINES
S	T	U	V	W	X	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	DESIGN	GROUP LEADER
T	U	V	W	X	S	B	C	D	E	F	A	H	I	J	K	L	G	N	O	P	Q	R	M		INSTRUMENTS
U	V	W	X	S	T	C	D	E	F	A	B	I	J	K	L	G	H	O	P	Q	R	M	N		TABLES
V	W	X	S	T	U	D	E	F	A	B	C	J	K	L	G	H	I	P	Q	R	M	N	O		AREA SWEEPER & DUST PAN
W	X	S	T	U	V	E	F	A	B	C	D	K	L	G	H	I	J	Q	R	M	N	O	P		PERSONNEL DIR.
X	S	T	U	V	W	F	A	B	C	D	E	L	G	H	I	J	K	R	M	N	O	P	Q		RECORDS CLERK

PERIODS:	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
EFFECTIVE DATES																								

Fig. 1. Personnel assignment card

With the use of one master assignment card, it is possible to run several classes with similar enrollment. Classes will vary in size or may not divide evenly, so in uneven or slightly larger groups, extra students may be held as reserves for absentees or may be given special assignments. Since the card uses student numbers rather than names, it can be used from year to year. In addition to assigning specific duties, the card will indicate subject division and will rotate the students through the divisions of the shop. Because assignments for the whole year are on the card, it can be operated by a student with a minimum amount of attention from the instructor.

To use the assignment card, the student enters the top with his number. Tracing this number down to the letter representing the effective period, he then reads his assignment to the right and opposite this letter.

Functions

Personnel plans often emphasize the maintainance of shop organization. However if all emphasis is placed upon the training values of these fully exploited, an orderly shop will be an automatic outcome. With this in mind, the following functions are suggested:

1. To provide opportunities for the development of leadership
2. To provide the opportunity for acceptance of responsibility under leadership
3. To provide a method under which group study can be accomplished
4. To provide and to stress conditions which maintain physical efficiency in work
5. To collect and to encourage student contributions

Organization

Since personnel organization is a vital part of any industrial establishment, it might be well to turn to that source for some ideas. In one organization, each department was set up in small divisions. Each division, which included from six to ten men, was headed by a leader. Within each group there could be found unskilled, semiskilled, and skilled workmen. The leader, a skilled tradesman, assigned work, acted as instructor, and checked the work for his group. He was responsible for the division to the department foreman. From these divisions came a steady flow of production even if the members were varied in skill.

High school students do not have the training nor the experience to direct a group as a fully qualified leader in industry. However, it is possible that students acting in such capacity may do many useful things in the school shop. At the same time, the training received would become a valuable part of an educational process.

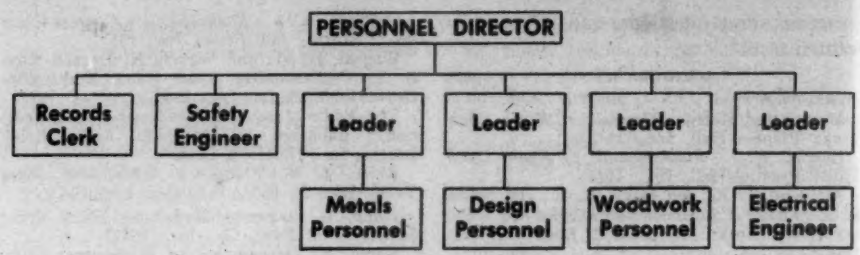

Fig. 2. Personnel organization chart

The plan in Figure 2 places each group of students under a leader. The leader is responsible to the personnel director. This director acting for the shop at large, also supervises the work of the records clerk and the safety engineer.

Activities

The activities of the organization should flow through the chain of authority. Duties should be clearly defined in order that all students will fully understand them. Any activity which cannot successfully be accomplished by students without friction with others is better handled by the instructor. The following is a suggested list of activities:

Personnel Director

1. Directs personnel organization
2. Starts cleanup promptly at five minutes before dismissal
3. Inspects shop during cleanup period and reports such activity completed
4. Takes charge in case the instructor is out of the room

Department Leaders

1. Supplies books and lesson sheets for his group
2. Acts as leader for group studies
3. Presents group problems to the instructor
4. Effects cleanup in his department in accordance with assignment card
5. Assigns replacements for absentees in the cleanup schedule

Safety Engineer

1. Inspects all shop equipment each week and makes provisions for the removal of all hazards discovered
2. Conducts safety meetings and discussions
3. Posts safety bulletins
4. May suggest changes in the interest of safety

Records Clerk

1. Check and report class attendance
2. File shop records

Others

1. As directed by the assignment card

Mental Cramps of the Engineer Writer

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A Symptom

". . . he was educated at a Midwest engineering school where no English courses were given because 'we engineers don't need no English.' " The quotation is from a *Boston Herald* account of a man who addressed a luncheon of authors, and who apparently felt that he might as well be facetious about his own limitations in the matter of written English expression. It was just as well to laugh it off.

The Diagnosis

The engineering profession, however, cannot laugh off the serious inefficiency in its program of operation caused by the lack of ability of many engineers to write. Their shibboleth is efficiency. An important factor in putting into effect their efficiently developed ideas lies in their ability to express them in logical, forceful English. Too often, there is marked inefficiency in the work of composing the reports and manuals of instruction by which the studies and designs of engineers are brought to the stage of consummation.

A large-scale test of the writing ability

of engineers was provided by the myriad of manuals of instruction issued during the war to describe the operation and maintenance of the intricate mechanisms of modern warfare. Spectacularly successful in their effectiveness, the manuals were produced under a severe handicap. In many cases, a preliminary step that was costly in time and money was found necessary — the task of teaching the engineer writers how to write. Those who taught them, the professors of English who were drafted for the work, are now strangely silent, in an atmosphere of enthusiastic publicity on the vivid pictorial techniques which the manuals featured. Opportunity has not knocked hard enough on the door of the English classroom, apparently. Case examples of deficient training abound; these and the unusually effective manual techniques are available for classroom study.

It is time that the executive in charge of technical writing projects stopped looking for "engineers who like to write," "men who can express themselves," or similar designations of the capacity for expression, which indicate the existing fortuitous connection between a man's technical knowledge and his ability to express that knowledge in understandable form. It is time that the ability to write technical copy be called just that — an ability that can be acquired, and not a talent, bordering on genius. Superior training must be provided in the engineering colleges for two important reasons. First, there is the increasing complexity in the scope of engineering knowledge, demanding the most efficient use of the English language in its exposition. Second, general industry asks for improved engineering literature, its appetite for such whetted by the war experience.

The practicing engineer, who has struggled for years with the deficiencies in English expression of his associates, is a layman in educational processes. He cannot say how college methods should be modified to correct this situation. It is his duty, however, to present to the professor of English the underlying difficulties in thinking which appear to handicap technically able engineers the moment they sit down to write.

A layman's classification — a scramble of subjects, traits, and methods that are important to the technical writer — is as follows: logic, imagination, vocabulary, thrift, style, practice, sympathy, drama, the newspaper way.

As he reads the following discussion of each item, the professional educator might well unscramble the list and sort out the items into the pedagogical category. List and discussion are offered as the layman's sincere desire for steps to adapt teaching methods to practical applications.

Logic

It seems difficult for a logical-thinking engineer to stick to the track of logic when he starts to write. A simple admonition will summarize the logical steps in the production of effective technical literature — carry your thinking to the point of establishing a definite program of action before you start to write; then rigidly follow this program. At the start of the *program* stage, one should clear the mind of grammatical and rhetorical inhibitions and let memory and imagination take control. Having decided upon the degree of knowledge of the subject that the reader is presumed to possess when he first picks up the book, one should try to transport himself back to that status.

The writer's experience, gained in mastering the intricacies of the machine about which he is to write should guide his arrangement of the steps of the exposition in such order as to give the reader the benefit of this experience. Recalling the point where he first saw the light, the writer should give this point emphasis. In preparing to establish the program, the writer should saturate his mind with the information contained in the notes, made as he took down and reassembled the machine, the salient points of advice received from experienced operators, and features which the records of maintenance show to be important. It is now time to record the program in the form of a text outline, giving chapter headings and the detailed coverage of each. As an example, the following resume of the text outline for a book describing a certain machine is presented.

Chapter	*What the writer must include*
Preface entitled "How to Use This Book"	A road map of the path to be followed by the reader if he is to acquire the knowledge of the apparatus most quickly.
General description	A bird's-eye view of the equipment as a whole and what it is supposed to do. Show the *woods;* avoid the *tree* details.
Installation	Things the operator must know in order to install the machine properly: power connections, checks to be made, and similar basic points. Details limited to how things are done, not why.
Operation	What the operator must do to make the machine perform. What happens when certain switches and valves are operated, *not* why it works that way. Details limited to how things are done, not why.
Maintenance (a lengthy chapter)	How to take proper care of the machine so it will perform: trouble charts, periodic maintenance schedules. Details limited to the *how*, not the *why*.
Elementary theory	If you are told to write for the second-year high school boy, by all means include this elementary chapter.
Theory of operation and detailed description of the various elements	Now for the details. The reader, by now, has seen the *woods* and is ready for the *tree* details. Tell the *why* of the procedures of the foregoing chapters on installation, operation, and maintenance.

Other types of apparatus will require a different approach from the foregoing. It is wise to subject the text outline to the cross fire of practical men who must operate the machine and keep it in condition. In its final form, it must represent a compromise of the opinion of such men. The relation of text to pictures is, of course, important, but beyond the scope of this article.

From now on, the text outline should be rigidly followed, except in cases where the writer's growing knowledge of the subject makes a change desirable.

(To be continued)

WHAT MAKES A GOOD TEACHER?

Twelve thousand students wrote on "The Teacher Who Helped Me Most," and the 12 personality traits most often mentioned, according to Paul A. Witty of Northwestern University were:

1. Co-operative, democratic attitude
2. Kindliness and consideration of the individual
3. Patience
4. Wide interests
5. Personal appearance and pleasing manner
6. Fairness and impartiality
7. Sense of humor
8. Good disposition and consistent behavior
9. Interest in pupils' problems
10. Flexibility
11. Use of recognition and praise
12. Unusual proficiency in presenting subject matter.

The main reasons for inferior projects in the school shop are as follows: (1) teachers poorly trained for teaching industrial education, (2) oversize classes, (3) lack of materials, (4) lack of tools and equipment, and (5) poor housing facilities. — *W. G. Williams.*

Stop! Look! and lessen accidents. — *National Safety Council.*

Evaluative Criteria for Vocational–Industrial Schools and Classes

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State College, Pa.

For the purpose of these criteria the instructional program has been classified into eight functional areas as follows: (1) school plant, (2) administration, (3) curriculum, (4) shop instructional program, (5) class instructional program, (6) teacher rating, (7) guidance program, and (8) pupil activities program. The items or statements listed under each area represent what might be considered the minimum essentials for a strong program of instruction.

The assumption is made that any program of instruction may be measured objectively. Based on the assumption this scale has been prepared for use in evaluating programs of vocational industrial education by: (1) state and local directors of vocational industrial education, (2) superintendents and supervisors of school systems, and (3) principals of vocational schools. The several sections of these criteria may be used collectively or individually in the evaluations of vocational industrial schools and classes.

These evaluative criteria have been prepared by a seminar group of graduate students in the department of industrial education at the Pennsylvania State College as follows: Dale M. Baird, cabinetmaking instructor, Tyrone Public Schools; George W. Davis, graduate student; William Gibbons, director of vocational education, Altoona; Robert Jacoby, director of vocational education, Hershey; Horace H. Lowell, machine-shop instructor, Williamsport Technical Institute; Edward F. Marburger, director of vocational education, Pottsville; H. E. Ross, graduate student; Harry W. Stone, division of school buildings, department of public instruction, Harrisburg; and Edward F. Thomas, radio instructor, Tyrone Public Schools.

A *working* committee composed of Davis, chairman; Baird; Gibbons; Jacoby; Stone; and Thomas assembled the initial information and data for these criteria. The final results represent the work of the group as a whole.

In developing this scale the members of the working committee have examined many published and unpublished rating scales but in the main they have drawn from their own experience and knowledge of vocational industrial education programs. The group has used as a guide in the preparation of its rating scale the "Evaluative Criteria and Educational Temperatures," 1940 Edition, published by the Co-operative Study of Secondary School Standards, 744 Jackson Place, Washington, D. C. The Section on Guidance was developed from ideas presented in an article in the *Vocational Guidance Magazine*: "Appraising Guidance in Secondary Schools" by William M. Proctor, Vol. IX, November, 1930, pages 58–66.

For the maximum objectivity assign point values to the items listed based on the following: excellent, 5; good, 4; average, 3; poor, 2; very poor, 1; does not exist, 0; does not apply, N.

For those who choose to use it, a suggested profile will be found at the end of this article. The point distribution at the end of each section will aid in plotting the profile.

The seminar group makes no claim for the adequacy or completeness of these evaluative criteria. It is hoped that through the experimental use of these criteria that the material may be refined and that others may develop evaluative criteria which will serve to evaluate state and local vocational industrial schools and classes more effectively.

School Plant

Name of school..... Date.....
City..... Rated by .....

Building and Site

.... 1. Site adequate with possibilities of expansion for future needs
.... 2. Site landscaped and play area free from obstructions
.... 3. Suitable environment, free from odors, smoke, noise, and dust
.... 4. Adequate and accessible parking areas
.... 5. Hard surfaced walks to entrances, exits, and to parking areas
.... 6. Hard sufaced play areas
.... 7. All doors open out, and exit doors equipped with panic bolts
.... 8. Adequate corridors, stairs, and exits, properly lighted
.... 9. Corridors, floors, and stair treads of suitable nonslip material
.... 10. Condition and location of fire hose and extinguishers
.... 11. Condition, location, and number of drinking fountains
.... 12. Adequacy and location of toilets (boys and girls)
.... 13. Instructors' rest rooms (men and women)
.... 14. Health room
.... 15. Lunchroom, cafeteria, and kitchen
.... 16. Heating plant and fuel storage adequate, offering no fire hazard
.... 17. Adequate custodial storage and workroom
.... 18. Instructional rooms arranged to facilitate co-ordination between shop and related instruction
.... 19. Building and grounds maintenance and housekeeping
.... 20. Exits from buildings and school property free from traffic danger
.... 21. General storage supply for one year
.... 22. Provisions for projection

Administrative Offices

.... 1. Size, location, and arrangement of principal's suite (principal's or director's office, conference room, secretary's office)
.... 2. Provision for heat, light, and ventilation
.... 3. Office furniture and equipment such as desks, files, duplicator, and telephone
.... 4. Accessibility to rest of school building
.... 5. Clock, program signal system, and P. A. system
.... 6. Fireproof record vault

Classrooms, Drafting Rooms, and Laboratories

Room number..... Type of work.....
.... 1. Adequate exits to corridors and exterior
.... 2. Sufficient number of work stations, desks, benches
.... 3. Room floor area at least 15 sq. ft. per pupil; room width not to exceed twice ceiling height
.... 4. Ceiling height, 11 ft. minimum
.... 5. Natural light: minimum glass area 16 per cent of floor area when on one wall, 25 per cent on two walls
.... 6. Window shades operated from middle
.... 7. Electrical illumination: minimum classrooms and laboratories,

one 200-watt globe for each 115 sq. ft. of floor area, minimum drafting room, one 200-watt globe for each 80 sq. ft. of area
.... 8. Blackboard, natural, slate, or glass, 4 ft. high, 16 ft. long, starting minimum 3 ft. from floor
.... 9. Distribution of heat, 70 deg.
.... 10. Provisions for ventilation
.... 11. Provisions for local removal of fumes, dust, chemicals, etc.
.... 12. Washroom facilities
.... 13. Pupil, clothing, and lunch lockers
.... 14. Provision for instructor's clothing
.... 15. Instructor's equipment; desk, chair, files
.... 16. Library reference shelf and table
.... 17. Supply and equipment storage cases or rooms
.... 18. Display cabinets and bulletin boards
.... 19. Floor satisfactory for specific use
.... 20. Suitable walls and ceilings without glare
.... 21. Housekeeping; floors, walls, lighting fixtures, and equipment
.... 22. General safety provisions
.... 23. Adequate projection facilities

Shops: *Type of work*.....

.... 1. Layout of equipment: machines, benches, cabinets
.... 2. Equipment suitable for purpose
.... 3. Working area around machines — 36 sq. ft. minimum
.... 4. Machines and equipment properly guarded
.... 5. Danger zones permanently marked
.... 6. Aisle through shop
.... 7. General illumination in shop
.... 8. Local illumination for each machine
.... 9. Emergency and main power switches installed and properly located
.... 10. Provisions for power outlets — 10 ft. max. operating distance
.... 11. Three-phase 220-volt current for use on power equipment and machines equipped with magnetic switches
.... 12. Separate room or compartment for dangerous operations — electric welding, spray painting, etc.
.... 13. Stock and supply storage, size adequate
.... 14. Toolroom or suitable cabinet
.... 15. Storage for visual aid equipment
.... 16. Fireproof storage for paints and combustible material
.... 17. First aid equipment accessible and available
.... 18. Washroom facilities
.... 19. Lockers for students' work clothing
.... 20. Lockers or cabinets for student jobs
.... 21. General safety provisions
.... 22. Adequate projection facilities
.... 23. Adequate drinking fountains
.... 24. Bulletin boards
.... 25. Instructor's equipment; desk, chairs, files
.... 26. Width of room not to exceed twice the ceiling height
.... 27. Minimum glass area equal to 16 per cent of floor area

Auditorium:

.... 1. Floor at grade level
.... 2. Corridors and doors for entrance
.... 3. Adequate exits to exterior
.... 4. Stage — minimum depth of 20 ft.
.... 5. Stage equipment such as curtains, storage space
.... 6. Stage lights and lighting
.... 7. Noiseless ventilation
.... 8. Located so as to permit use independently of rest of building
.... 9. Seating capacity adequate for school enrollment
.... 10. Visibility
.... 11. Acoustics
.... 12. Motion picture booths and equipment
.... 13. Emergency lighting

Gymnasium:

.... 1. Located above grade
.... 2. Ceiling height: minimum of 18 ft.
.... 3. Floor area: minimum one 41 by 66-ft. play space for each 600 pupils
.... 4. Seating capacity sufficient for maximum enrollment
.... 5. Ventilation
.... 6. Window area: minimum 20 per cent of floor area
.... 7. Located so as to permit use independently of rest of building
.... 8. Shower and locker rooms for boys and girls
.... 9. Hot water to showers and lavatories
.... 10. Visibility
.... 11. Acoustics
.... 12. Satisfactory floor
.... 13. Emergency lighting
.... Total number points

Rating and Point Equivalent:

Excellent	417–520	Average	209–312	Very poor	0–104
Good	313–416	Poor	105–208		

Administrative Unit

Name of school..... Date.....
City..... Rated by.....

Qualifications of Administrator

.... 1. Trade and industrial background
.... 2. Educational background
.... 3. Meets state certification requirements
.... 4. Attends professional conferences
.... 5. Professional association affiliations
.... 6. Consistent professional improvement

Administrative Duties

.... 1. Vocational-industrial survey up to date
.... 2. Selects qualified instructors and maintains a file of prospects
.... 3. Preparation of budget and annual report of costs for superintendent and school board
.... 4. Purchase of supplies
.... 5. Maintains adequate public relations
.... 6. Maintains adequate permanent records
.... 7. Conducts teacher meetings
.... 8. Sponsors a teacher improvement program
.... 9. Observes and inspects regularly
.... 10. Sets up class schedules and objectives
.... 11. Utilizes advisory committees — labor, management, business
.... 12. Plans for expansion and program improvement
.... 13. Program legally sound
.... 14. Maintains adequate adult extension program
.... 15. Maintains guidance, placement, and follow-up
.... 16. Selects students, using scientific procedures
.... 17. Sponsors functioning safety and health program
.... 18. Maintains accident records and individual shop statistics
.... 19. Industrial-arts program co-ordinated with vocational-industrial program
.... 20. Adequate secretarial help

Supervisional Duties

.... 1. Holds conference with teachers for professional improvement
.... 2. Observes classes and rates teachers
.... 3. Keeps materials of instruction up to date
.... 4. Controls shop production
.... 5. Sponsors grading standards
.... 6. Co-ordinates all departments
.... 7. Has integrated program with other departments of school and local system
.... 8. Maintains an adequate inventory of supplies, tools, and equipment
.... 9. Arranges public exhibitions for community education
.... Total number points

Rating and Point Equivalent:

Excellent	141–175	Average	71–105	Very poor	0–35
Good	106–140	Poor	36–70		

Curriculum

Name of school..... Date.....
City..... Rated by.....

Course offerings:

.... 1. Courses planned to serve community needs
.... 2. Courses planned to serve individual needs

.... 3. Provisions for evening or supplementary training
.... 4. Provisions for related instruction for apprentices
.... 5. Provisions for part-time instruction

Course content:
.... 1. Course content determined by conference between teachers, advisory committees, and school officials
.... 2. Instruction based on use of real jobs
.... 3. Instructional materials derived from industry
.... 4. Content arranged in most effective order of difficulty
.... 5. Content under constant revision to meet needs of local industry
.... 6. Follow-up of students to determine needed curriculum revisions

Related Courses:
.... 1. Groups segregated according to trade
.... 2. Related courses and practical applications
.... 3. Co-ordination of related courses and shopwork

Length of time shops and classes meet
.... 1. Do shop classes meet minimum of 15 clock hours per week?
.... 2. Do students spend 30 per cent of the time in related shop subjects?
.... 3. Do students spend 20 per cent of time in academic subjects including physical education?

Library:
.... 1. Skill and knowledge of librarian in dealing with technical publications
.... 2. References and journals in harmony with aims of school
.... 3. Reference books and current journals for each trade taught
.... 4. Classification of all books and periodicals
.... 5. Cataloguing of all books and periodicals
.... 6. Evidence of literature from industry and publishers
.... 7. Evidence of posters and book jackets for motivation
.... 8. Quality and number of chairs and study tables
.... 9. Illumination conducive to study
.... 10. General atmosphere conducive to purposeful study
.... 11. Timely and current subject matter prominently displayed
.... 12. Bulletin board utilized
.... Total number points

Rating and Point Equivalent:

Excellent	117–145	Average	59–87	Very poor	0–29
Good	88–116	Poor	30–58		

Shop Instructional Program

Name of school..... Date.....
Shop..... Instructor.....
City..... Rated by.....

Instructional Plans and Activities
.... 1. Differentiated job assignments to provide for individual student progress
.... 2. Trade analysis
.... 3. Course outline of shopwork and trade theory based on trade analysis
.... 4. Objectives of course clearly stated
.... 5. Some type of daily lesson plan or outline in use
.... 6. Planned program of field trips to the local industries
.... 7. Provides for developing desirable attitudes and appreciations as well as knowledge, skills, and understanding

Instructional Materials
.... 1. Textbooks sufficiently recent in publication
.... 2. Text content well organized and adapted to the needs and degree of development of pupils
.... 3. Textbooks satisfactory in appearance and quality
.... 4. Textbook not regarded as full authority in the field
.... 5. Supplementary materials used extensively
.... 6. Duplicated material effectively used
.... 7. Notebooks used as an effective aid to learning
.... 8. Bulletin boards used effectively
.... 9. Visual aid equipment and films used
.... 10. Pictures, models, mock-ups, and other illustrative materials available
.... 11. Periodicals and pamphlets used when appropriate
.... 12. Adequate number of reference books

Instructional Methods
.... 1. Careful and clear job assignments
.... 2. Conducts theory or related information classes regularly
.... 3. Makes frequent use of the group demonstration method
.... 4. Uses effectively a variety of instructional methods including lecture, demonstration, illustration, group discussion, supervised practice, text and reference reading, experiment, texts, questioning and visual aids
.... 5. Job, operation, and other types of instruction sheets used effectively
.... 6. Observes each trainee periodically to check progress
.... 7. Students' record of daily work on time cards
.... 8. Production work planned and regulated to fit plan of instruction
.... 9. Optimum skills developed by repetitive operations
.... 10. Evidence of up-to-date progress charts
.... 11. Interest centered on the student rather than on subject matter
.... 12. Evidence of pupil planning, executing, and evaluation of work

Instructional Evaluation
.... 1. Record of student progress kept
.... 2. Maintenance of standards of attainment comparable to those in industry
.... 3. Planned testing program
.... 4. Tests easily administered, easy to take, and easy to score
.... 5. Objective system of grading
.... 6. Consults guidance bureau for complete record of problem cases

Pupil — Teacher Relations
.... 1. Students entering upon their work promptly
.... 2. Students showing an active and sustained interest
.... 3. Student conduct orderly and self-disciplined

Shop Management
.... 1. Room orderly, attractive, and showing evidence of good housekeeping
.... 2. Light, heat, and ventilation regulated
.... 3. Procedure for shop cleaning
.... 4. Proper storage racks for materials and hand tools
.... 5. Efficient assignment of trainees to jobs
.... 6. Equipment in good condition
.... 7. Periodic checking of motors and machines
.... 8. Safety devices in evidence
.... 9. Reports and records up to date
.... Total number of points

Rating and Point Equivalent:

Excellent	196–245	Average	99–147	Very poor	0–49
Good	148–196	Poor	50–98		

Class Instructional Program

Name of school..... Date.....
Subject..... Instructor.....
City..... Rated by.....

Instructional Plans and Activities
.... 1. Students segregated, vocational students only
.... 2. Segregated in homogeneous groups or by trades
.... 3. Course outline correlation closely with the trade being taught
.... 4. Course outline adapted to the levels of group
.... 5. Provisions for developing desirable attitudes and appreciations as well as knowledge, skills, and understanding

Instructional Materials
.... 1. Textbooks sufficiently recent in publication
.... 2. Text content well organized and adapted to needs and degree of development of pupils
.... 3. Textbook satisfactory in appearance and quality
.... 4. Supplementary materials used extensively
.... 5. Duplicated material effectively used
.... 6. Bulletin boards used effectively

.... 7. Periodicals and pamphlets used when appropriate
.... 8. Pupils know how to use the various instructional material effectively
.... 9. Equipment, supplies, and other materials readily available for classroom use

Instructional Method and Management

.... 1. Has definite procedures and objectives for each unit of learning
.... 2. Class period time arranged for introduction of subject, coverage of content, supervised study, assignment
.... 3. Uses effectively a variety of instructional methods including: lecture, illustration, blackboard, group discussion, text and reference reading, experiment, tests, questioning, work sheets, visual aids, reports
.... 4. Work sheets, assignment sheets, and duplicated materials used
.... 5. Students participating freely in classroom activities
.... 6. Helps pupils to learn how to study, plan, execute, and evaluate
.... 7. Room orderly and attractive
.... 8. Class operated in businesslike and enthusiastic manner

Pupil — Teacher Relations

.... 1. Teacher and enthusiasm toward work
.... 2. Students' active and sustained interest
.... 3. Students' conduct orderly and self-disciplined

Instructional Evaluation

.... 1. Objective system of grading
.... 2. Reports, records, grades up to date
.... 3. Planned testing program
.... 4. Tests used as a basis for further instruction
.... 5. Tests easily administered, easy to take, easy to score
.... 6. Student informed of his progress periodically
.... Total number of points

Rating and Point Equivalent:

Excellent	125–155	Average	63–93	Very poor 0–31
Good	94–124	Poor	32–62	

Teacher Rating

Name of school..... Date.....
City..... Rated by.....

Personality

.... 1. Appearance
.... 2. Self-control
.... 3. Enthusiasm
.... 4. Forcefulness
.... 5. Humor
.... 6. Teaching voice

Teacher Preparation

.... 1. Skilled in trade and trade knowledge
.... 2. Knowledge of educational principles
.... 3. Command and use of the English language
.... 4. Satisfies certification requirements
.... 5. Up to date in developments of trade

Teacher Instructional Plans

.... 1. Trade analysis
.... 2. Course outline
.... 3. Preparation of job, information, and operation sheets
.... 4. Selection of visual aids, models, and illustrative material

Professional Attitude

.... 1. Interested in growing professionally
.... 2. Interested in growing culturally
.... 3. Punctual in meeting classes and performance of professional duties
.... 4. Co-operative with administration and faculty members
.... 5. Makes effort to test the merits of suggestions
.... 6. Responds well to constructive criticism
.... 7. Interested in the life of the community
.... 8. Membership in professional organizations

Instructional Management

.... 1. Room or shop orderly and attractive
.... 2. Room or shop equipment arranged for efficient operation
.... 3. Efficient assignment of trainees to jobs
.... 4. Keeps equipment in good condition
.... 5. Regulation of room temperature, ventilation, and illumination
.... 6. Organization of toolroom or cabinets
.... 7. Organization of stock and supply room
.... 8. Records and forms well kept and up to date

Skill and Knowledge of Methods and Teaching Techniques

.... 1. Definiteness in making assignments
.... 2. Use and quality of lesson plans
.... 3. Skillfulness in using a variety of teaching methods
.... 4. Students kept busy with assigned jobs at all times
.... 5. Use of instruction sheets
.... 6. Aptness in using illustrative material
.... 7. Use of visual aids and models
.... 8. Maintains high standard of attainment
.... 9. Skill in detecting and correcting errors
.... 10. Co-ordination of safety and job instruction
....*11. Skill in evaluating the results of instruction
.... 12. Use of progress charts or progress records

Pupil — Teacher Relations

.... 1. Students stimulated to put forth best effort
.... 2. Students' promptness in attending to routine matters
.... 3. Enthusiasm and sustained interest of students
.... 4. Conduct orderly and disciplined
.... 5. Students making normal subject matter progress
.... 6. Students informed periodically of progress
.... Total number of points

Rating and Point Equivalent:

Excellent	197–245	Average	99–147	Very poor 0–49
Good	148–196	Poor	50–98	

Guidance Program

Name of school..... Date.....
City..... Rated by.....

Organization and staff

.... 1. Vocational counsellor, chief or director trained for guidance work
.... 2. Qualified teachers to teach guidance
.... 3. The entire staff regarding guidance as co-operative effort and responsibility
.... 4. Home and school co-ordination
.... 5. Guidance considered as adjustment and growth and not the acquiring of information and skill
.... 6. Assistants and teachers qualified to evaluate and handle test information with skill
.... 7. Provisions for, and evidence of, individual or group research

Records and Pupil Information

.... 1. Complete cumulative records and filing system available
.... 2. Use made of psychological, achievement, and physical examinations
.... 3. Satisfactory provisions for giving and supervising standardized examinations
.... 4. Selection of tests for testing program

Advisory Procedures

.... 1. Provisions for individual conference with director, counselor, or teacher
.... 2. Provisions for guidance through faculty advisory system
.... 3. Guidance through faculty class advisory system
.... 4. Number of pupils assigned to each adviser or counselor in comparison to period for counseling

Placement and Follow Up Program

.... 1. Co-ordinator to work between schools, business, and industry
.... 2. Provisions for providing full time employment to students
.... 3. Provisions for providing part time employment to students
.... 4. List of employment opportunities kept up to date
.... 5. Familiarity of faculty and counselors with job requirements
.... 6. Proper placement of student on job

.... 7. Accurate check made and record kept of student's progress made on job, and reason for job changes
.... Total number of points

Rating and Point Equivalent:

Excellent 89–110 Average 45–66 Very poor 0–22
Good 67–88 Poor 23–44

Pupil Activity Program

Name of school..... Date.....
City..... Rated by.....

Student Government

.... 1. Organization and purpose of student council as indicated by constitution
.... 2. Promotion of co-operation and friendliness
.... 3. Sponsored activities by the council
.... 4. Faculty advisory relationships to council
.... 5. Functional aspects of school patrol

Athletics

.... 1. Emphasis of school on athletics (over or under)
.... 2. Variety of athletic program
.... 3. Student participation in athletics
.... 4. Intramural program
.... 5. Interest of student body and community in program

Clubs

.... 1. Emphasis of school in club activities
.... 2. Advisory system for organizations
.... 3. Comparison of club aims and school aims
.... 4. Student interest in clubs
.... 5. Sponsored activities of clubs

Musical Organizations

.... 1. Purpose of musical organizations
.... 2. Variety of organizations
.... 3. Membership in each organization
.... 4. Quality of performance at public appearances
.... 5. Student and community support of organizations
.... 6. Percentage of students participating

Dramatics

.... 1. Emphasis of school on dramatics
.... 2. Purpose of dramatics in the school
.... 3. Interest of students as shown by participation
.... 4. Quality of performance
.... 5. Interest of student body and community in dramatics
.... Total number of points

Rating and Point Equivalent:

Excellent 117–130 Average 53–78 Very poor 0–26
Good 79–116 Poor 27–52

Rating Chart

Name of school..... Date.....
City..... Rated by.....

SECTION	Rating				
	0	1	2	3	4 5
	Very Poor	Poor	Average	Good	Excellent
School Plant					
Administration					
Curriculum					
Shop Instruction Program					
Class Instruction Program					
Teacher Rating					
Guidance Program					
Pupil Activity Program					

Rating chart

Plotting the Profile

The point distribution at the end of each section was developed by using the product of the number of items and the point value, (that is: excellent, 5; good, 4; average, 3; poor, 2; and very poor, 1; does not exist, 0; does not apply, N). With this as a base, the sum of the points in the column at the right of each section gives the point range from which can be determined the curve to be plotted on the profile.

Check List for School-Shop Planning

HERSCHEL F. EASTMAN
Wilson Junior High School
Muncie, Ind.

With the planning of many new schoolbuildings, it is time to stop and think through our plans, especially those of the industrial-arts shops and laboratories. Having this in mind I submit this check list as an aid to school-board members, administrators, architects, and teachers for more complete planning.

Types of Industrial-Arts Shops

General Shop: a variety of centers of work in a single-room laboratory

General Unit Shop: a center of work in a single room

Unit Shop: a single activity of industry in a single room

Trade Shop: specialized training for a single activity of industry

Basic Considerations

1. *A philosophy of industrial arts*
2. *Objectives of industrial arts*
3. *Aims of industrial arts*
4. *Funds available for building purposes*
5. *Present and future needs*
   a) Trends in industrial education
   b) Size of school

General Considerations

1. Size of community
2. Type of community
3. State requirements
4. Objects that are permanently fastened on the wall should be recessed
5. Twelve feet, minimum ceiling height
6. Provide adequate storage facilities
7. Locks so designed to require a minimum number of keys
8. Alarm bell for fire and clean-up
9. Gas, compressed air, and electrical outlets should be conveniently located
10. Teacher interest
11. When more than one room is required they should be arranged in a unit
12. The shop should not be use das a *hall* to other parts of the building
13. Telephone facilities
14. Electric clock
15. The shop should have a pleasing aesthetic appearance

Safety

1. *Electricity:*
   a) Fuse and switch boxes protected from metallic particles
   b) Switches mounted on machines so that they can be easily reached
   c) Fuses of the right size
   d) Power equipment wired on separate circuits
   e) A master switch that can be locked
   f) Sub-master switches that can be controlled from the teacher's office
   g) Power equipment should be grounded
2. *Power equipment:*
   a) Arrangement of the machines in accordance with the safety standards
   b) Workable guards for cutting tools on machines that require them
   c) Gears, wheels, etc., well guarded
   d) Eye protection for machines that produce flying particles

e) Painted safety zones around power equipment
3. *Fire:*
a) Metal containers for waste
b) Metal storage cabinets for flammable material
c) Fire extinguishers conveniently located
(1) Carbon tetrichloride for electric motors
(2) Foam extinguishers for other purposes
d) Locked storage areas
e) Provisions made so that only a small amount of materials are made available to students
f) Hoods and exhausts for noxious gases and fumes
g) Booths around welding units
4. *Floors:*
a) Nonslippery floors
b) Avoid different floor levels
5. *Avoid overhead storage:*
a) Eliminate hazards when it is necessary
6. *First-aid cabinets and materials*
7. *Doors:*
a) Doors of partitions should swing toward nearest exit
b) Outside doors swing outward
c) Single doors for entrances
d) Large door on outside wall
(1) For automobiles, large projects, etc.
(2) For new equipment

Arrangement of Shop

1. *Centers of work:*
a) Dirty areas together
b) Processing of same material in a concentrated area
c) Centers having a direct relationship should be close together
d) Items that are used in many centers should be centrally located
e) Infrequently used areas should be placed in an out-of-the-way place
f) Most frequently used work stations near light
g) Wide general aisles of travel
h) Direct aisles of travel to related centers of work
i) Tool panels for each center of work
j) Built-in accessories
k) Things needed at beginning and end of period near exit
2. *Open spaces — Assembly:*
a) Type of project to be constructed
3. *Power equipment:*
a) Logical sequence of operations of a single material
b) Machines processing large pieces away from exits
c) Aisles of traffic away from rapidly rotating machines
d) Wiring systems to machines should be easily altered
e) Distribute duplicate machines which are used in more than one center of work
4. *Benches:*
a) Steel body with wood tops for most purposes
(1) Lockers in body
(2) One bench for each four pupils
b) Metal tops for finishing
c) Fire resistant tops for forging, welding, etc.

Light

1. *Consult a good lighting engineer for help*
2. *Amount of light:*
a) Fifteen foot-candles for general light
b) Thirty to fifty foot-candles for close work
3. *Natural light — Windows:*
a) Pupils must not face light
b) One to six ratio of glass to floor area
c) Venetian blinds for light direction
d) Steel sash
e) Window sill from 40 to 48 inches from floor
f) Windows extend to ceiling
g) Unevenness of light due to type of day
4. *Artificial light:*
a) Artificial light more even than natural
b) Fluorescent defused luminaries recessed in ceiling
c) Luminaries placed to make even light
d) Luminaries independently controlled
e) Supplementary lights on machines
f) Lighting system easily maintained
g) Cleaning and maintenance schedule set up and followed
5. *Paint:*
a) Flat paint on walls and ceiling
b) High coefficient of reflection above eye level and ceiling
c) Darker shades below eye level
d) Light reflecting floors
e) Aesthetic appearance

Ventilation and Heating

1. *Ventilation:*
a) Change air from six to ten times per hour
b) Hoods and exhausts for removal of noxious gases and fumes
c) Separate exhausts for forge smoke and paint fumes
d) Controlled humidity
e) A quiet system that can be repaired easily
2. Heating:
a) Steam heat
b) Radiators off floor and recessed in wall
c) Automatically controlled temperatures from 65 to 68 degrees

Dust Collection

1. A quiet system that is easily repaired
2. Ducts in the floor
3. Screens over entrance of ducts at machines
4. Avoid turns in ducts whenever possible
a) Have cleanout traps at sharp turns

Noise Control

1. *Insulation:*
a) Insulate walls and floors from foundation
b) Acousticized plaster for walls and ceiling
c) Celotex for ceiling
d) Sound-absorbing floors
2. *Power equipment:*
a) Purchase machinery of good quality
b) Mount machines on concrete footings
c) Mount machines on cork or rubber
d) Direct drive for machinery
e) Keep machinery in best repair
f) Keep machinery in balance, especially the rapidly rotating types
g) Keep machinery away from radiators and pipes that lead to other parts of the building
3. *Tight-fitting doors and windows*
4. *Eliminate ceiling beams*
5. *Keep room free from pipes, ducts, etc., leading to other rooms*

Location

1. End of wing to utilize hall space
2. Near front of building
3. Interdepartmental relationship
4. Ground-floor level
5. Separate building in some cases

Size

1. Seventy-five square feet per pupil (excluding storage space)
2. The width-to-length ratio should be about one to one and one-half

Shape

1. *Rectangular:*
a) Avoid *T*, *L*, and *V* shapes
b) Avoid posts and other obstructions in the shop, as they make blind spots for the teacher
c) Avoid nooks and pockets

Open Floor Space and Aisles

1. *Open floor space:*
a) For assembly of projects
b) For experimentation with large projects
2. *Aisles:*
a) Approximately 4 ft. wide
b) Wider near exits
c) Direct aisles to and from related centers
d) Keep away from rapidly rotating machines

Sanitation

1. Wall from floor to eye level should be easily cleaned
2. Arrange machinery to facilitate easy cleaning
3. Floors finished to promote sanitation

Auxiliary and Service Areas

1. *Storage lockers:*
a) Individual lockers for projects
b) Individual lockers for clothing
c) Separate room for project storage
2. *Supply storage:*
a) Large amounts of supplies kept locked up
b) Small amounts of supplies accessible to pupils
c) Vertical storage racks for large lumber and metal
3. *Planning and drawing area:*
a) Thirty square feet per pupil
b) Glass partition from shop room for cleanliness
c) Asphalt, cork tile, or linoleum floor
4. *Library:*
a) Tables and chairs for group discussion

b) Motion-picture facilities
c) Books, periodicals, and pamphlets

5. *Teacher's consultation room or office:*
   a) Within eyesight of shop
   b) To keep teaching aids together
   c) For private conferences
   d) Sub-master switches for power equipment
6. *Tool distribution:*
   a) Tool panels for each center of work is best plan
   b) Tool room
7. *Washing facilities:*
   a) Near exits
   b) Large round or semiround washing stands
      (1) Foot-pedal operation
   c) Easily cleaned
8. *Drinking fountains:*
   a) One fountain to each 15 pupils
   b) Placed throughout shop to avoid congestion and excessive travel
9. *Bulletin boards:*
   a) Placed throughout shop
      (1) Near entrance
      (2) Near tool panels
      (3) Over drinking fountains
10. *Blackboards:*
   a) Stationary
      (1) Avoid placing where light will glare on them
      (2) Do not place between windows
   b) Portable
      (1) Easily moved from one area to another
11. *Display cases:*
   a) At least one in shop
   b) In corridors that are most frequently used throughout building
   c) Should be well lighted
   d) Should be recessed in wall
   e) Doors in back that can be locked

Problems and Projects

A DRAFTING KIT FOR SCHOOL OR HOME

ROBERT W. ENGLISH
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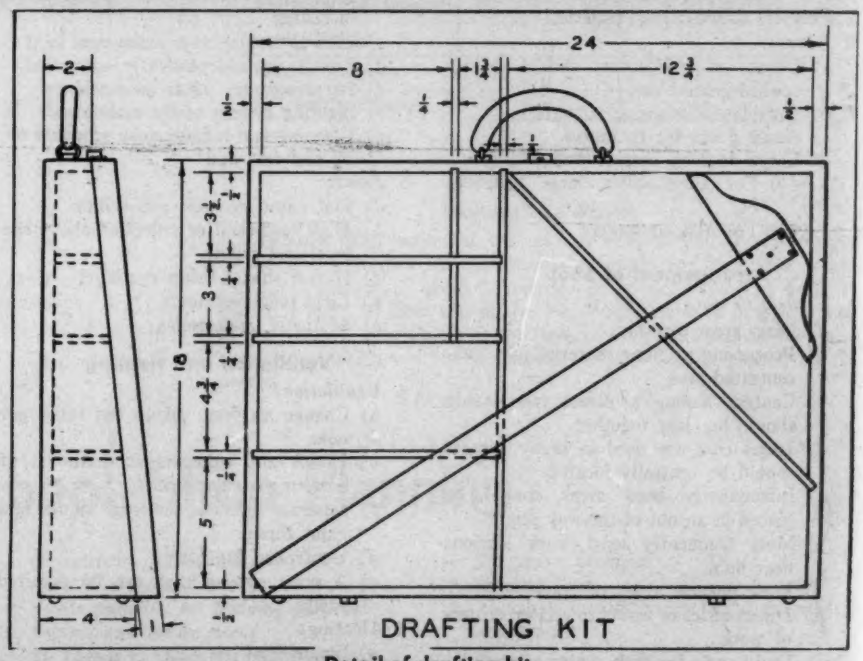
Carbondale, Ill.

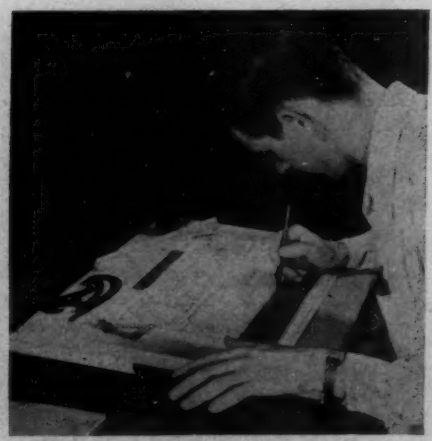
One way to solve the problem of where to put a drawing board is suggested by this project. Most cases for drawing instruments do not provide for T square and board. This kit will appeal to the student, the teacher, and to the draftsman because it is convenient to use when drawing and it provides storage for all of the most commonly used items, drafting equipment, drawing paper, and reference books. The kit itself can be stored in an 18 by 24 by 6-in. space.

In schools cramped for storage space, and in departments where combinations of activities do not provide a drafting room with desks that have adequate storage space, kits of this type may be issued to each student.



Detail of drafting kit

Kit in open position



Kit in use

If each kit is equipped with T square, triangles, set of instruments, irregular curves, lettering guides, scale, pencils, erasers, paper, paper fasteners, and text or reference books, the problem of issuing equipment to students can be greatly simplified.

As a woodworking project this kit might be made by students at various grade levels. Duplicates of this case to equip a department might be made as an assembly line project by a woodworking class.

The kit shown here involved the following: measuring, layout, sawing to size, miter sawing, dadoing, planing, gauging, gluing, nailing, drilling, setting hinges, finishing, attaching hasp, braiding handle, attaching handle.

Such kits have been an aid and encouragement to students to do outside work in drawing.

GENERAL-SHOP PROGRESS CHART

FOR GRADES 7 AND 8

2 Year Course — 2 Hrs. Per Week

MARTIN PETERSON, CINCINNATI, OHIO

	1	2	3	19	20	21
Sheet Metal						
1. Develop a pattern						
2. Measure the amount of material						
3. Clean sheet metal						
4. Make the layout on the metal						
5. Cut sheet metal with snips						
6. Cut sheet metal with squaring shears						
7. Mark for detail cuts and bends						
8. Make a right angle bend						
9. Use a bar folder						
10. Use a bar folder						
11. Punch holes with a rivet punch						
12. Set and head tinners rivets						
13. Form sheet metal on stakes						
14. Tin a soldering copper						
15. Solder a joint						
16. Wire an edge						
17. Make a lock seam						
18. Use enamel						
19. Use lacquer						
20. Use a hollow punch						
21. Shape metal with a mallet						
22.						
23.						
Bar Metal						
1. Prepare a design						
2. Measure the amount of material required						
3. Make the layout on the metal						
4. Cut metal to size with a hack saw						
5. Cut metal to size with machine shears						
6. Mark for detail cuts and bends						
7. Cut iron with a cold chisel						
8. File iron						
9. Hammer bends in iron						
10. Form a scroll with a bending fork						
11. Form metal by heating and hammering						
12. Smooth surface with emery cloth						
13. Polish surfaces with steel wool						
14. Measure and mark for holes						
15. Drill holes on drill press						
16. Countersink the holes for screws and bolts						
17. Use center punch for drilling						
18. Set and head rivets						
20. Thread a rod						
21. Tap a hole						
22. Twist wrought iron						
23. Shape wire						
24. Remove rust						
25. Peen a surface						
26. Apply a finish						
27.						
28.						
Art Metal						
1. Prepare a design						
2. Prepare a pattern						
3. Planish a bowl or tray						
4. Use a jeweler's saw						
5. Shape with a file						
6. Clean copper with nitric acid						
7. Shape metal by bending						
8. Decorate by tapping a design						
9. Etch a design						
10. Smooth an edge with a file						
11. Smooth with emery cloth						
12. Smooth and polish with steel wool						
13. Polish with rouge on a buffer						
14. Color copper and brass with a flame						
15.						
16.						
Woodwork						
1. Draw a plan for a project						
2. List sizes on "bill of material"						
3. Measure and draw lines for saw cuts						
4. Cut lumber to size with a cross-cut saw						
5. Cut lumber to size with a rip saw						
6. Cut lumber to size with a back saw						
7. Adjust a plane for surface planing						
8. Plane a surface						
9. "Square" a board by planing						
10. Plane a chamfer, bevel, or taper						

Progress chart by Martin Peterson, Cincinnati, Ohio

GENERAL-SHOP PROGRESS CHART (Continued)

	1	2	3	19	20	21
11. Prepare a pattern for a contour design						
12. Cut curves with a coping saw						
13. Cut curves with a scroll saw						
14. Cut curves with a band saw						
15. Smooth curves with a spoke shave						
16. Cut a curve with a draw-knife						
17. Smooth curves with a wood file						
18. Fasten with nails and brads						
19. Measure for location of screws						
20. Drill holes for screws						
21. Countersink for heads of screws						
22. Drive screws securely						
23. Bore holes with an auger bit						
24. Fasten joints with dowels						
25. Fasten joints with glue						
26. Fit a hinge						
27. Use a shooting board						
28. Use a miter saw						
29. Use a chisel						
30. Sand surfaces efficiently						
31. Calculate the cost of a project						
32.						
33.						
Finishing						
1. Prepare a surface for finishing						
2. Apply an oil finish						
3. Apply stain						
4. Apply shellac						
5. Apply varnish						
6. Apply enamel						
7. Apply lacquer						
8. Polish a finish on the lathe						
9. Polish with pumice and rottenstone						
10. Decorate with colors						
11.						
Wood Turning						
1. Turn a spindle						
2. Turn with a face-plate						
3. Use a chuck						
4. Prepare a design for turning						
5. Turn duplicate pieces						
6. Glue stock for turning						
7. Polish a finish on the lathe						
8. Calculate cost of turning project						
Electrical Work						
1. Draw simple wiring circuits						
2. Connect simple wiring circuits						
3. Splice and tape wires						
4. Tap and taper wire						
5. Solder appliance joints						
6. Wire an extension cord						
7. Wire a lamp						
8. Read meters						
9. Make an electric magnet						
10. Make a buzzer						
11. Make a sounder						
12. Make a switch or key						
13. Make a simple motor						
Mechanics						
1. Connect pipe fittings						
2. Thread a rod or pipe						
3. Tap a hole						
4. Cut glass to size						
5. Fasten with screws						
6. Fit a hinge						
7. Remove rust						
8. Use wrenches						
9. Sort nails to kind and size						
10. Sort screws to kind and size						
11. Sharpen a knife						
12. Sharpen a chisel						
13. Sharpen an axe						
14. Sharpen a plane iron						
15.						
16.						
Printing						
1. Fill in the job case card						
2. Set a statement in 24-point type						
3. Set and justify a paragraph						
4. Set a statement using quotation marks						
5. Set type in balanced layout						
6. Make a copy using proof press						
7. Print copies on the letterpress						
8. Clean the press						
9. Learn lock-up in a chase						
10. Distribute type accurately						
11.						
12.						

Progress chart by Martin Peterson, Cincinnati, Ohio

INDIAN SILVERSMITHING

BEN HUNT
Hales Corners, Wis.

(*Continued from page 77 of the February, 1948, issue*)

Belt Buckles

Belt buckles made of silver and turquoise, or just plain silver, are always attractive and there is not a man, boy, or girl who would refuse to accept one. If the reader knows how to do leather tooling and carving, he can produce a belt that will be a real piece of art. But if not, it is always easy to buy a belt and make a buckle for it. Some belts have snaps on them for attaching the buckles. If one of those cannot be obtained, it is a simple matter to rip the stitching, insert the buckle, and sew up the belt again, using the same holes to do the stitching.

As is evident from Plates 18 and 19, Indian-made buckles are as a rule quite a bit larger and more showy than the ordinary buckles found on the market, and they are made in a greater variety of shapes and styles.

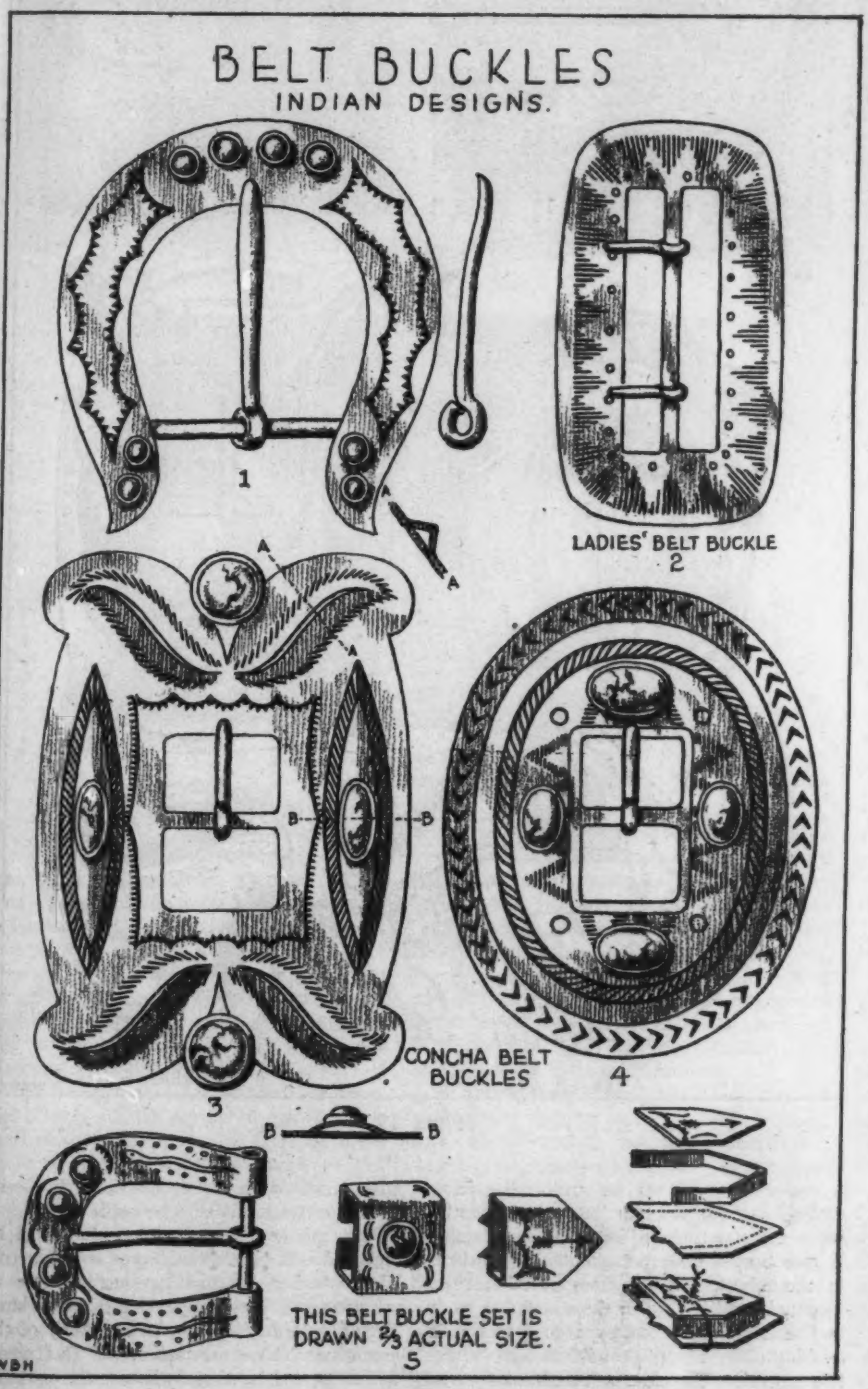


Plate 18

Fig. 7. Work log with depressions used to bump up ornaments for the buckle shown in Fig. 3, Plate 18

Figure 1 on Plate 18 is a rather plain horseshoe buckle with the bar of round wire flattened at the ends and soldered to the back. The tongues, as a rule, are loose and have no fitted setting, the belt holding them in position.

Figure 2, Plate 18, is a double tongued ladies buckle and was on a belt as wide as the buckle itself.

Figure 3, Plate 18, is a very showy buckle, and was very likely taken out of a concha belt set. There are two methods of making this type of work. One, bumping up the raised ornaments on a block of wood or on a pitch block, and the other a method of making the raised sections separately and soldering them in position. Jewelry made in this latter fashion, if the edges are filed down to meet the base, look very much like fine jobs of bumping up. The author likes this method best because it leaves the base or background of the piece with a smooth, even surface. Then, too, heavier gauge silver can be used for the buckle proper when the ornaments are soldered on. A buckle should look substantial and 16- or 14-gauge silver is commonly used, or if you have no heavy silver, two thinner gauge pieces can be soldered together as was shown in the article on bracelets in the January, 1948, issue.

Figure 4, Plate 18, also is a concha buckle with the outer edge flat and the rest slightly domed. All large buckles must be slightly curved to fit the wearer's body, for otherwise the ends project. The bending, of course, should be done before the stones are set.

Figure 5, Plate 18, is a rather small buckle from a western style belt. Included in this figure are a belt loop and an endpiece. Some of these belts have two loops as is shown in Figure 6.

Plate 19 shows four buckles designed by the author. Figures 1 and 2, Plate 19, show details of the buckles in Figure 6. Figure 1, Plate 19, is made by stamping and bumping up the face and soldering a back to it. Figure 2, Plate 19, is a rather ornate buckle of single thickness 18-gauge silver, twisted wire, and rain drops. All the buckles shown are ornamented with turquoise.

Figure 3, Plate 19, is ornamented with four turquoise, but, if necessary, the top and bottom oval stones may be replaced by raised and stamped ornaments, or as mentioned before, these ornaments may be raised and stamped, and then soldered on. The square buckle shown in Figure 4, Plate 19, is a style quite often used on concha belts, but this buckle looks equally well on a leather belt. In the lower right hand corner are three raised ornaments that lend themselves well as ornaments on large buckles. Quite frequently one sees Indian belt buckles on which turquoise stones have been mounted where no actual space was allowed for such ornamentation. Figure 3, Plate 18, looks as though the stones were added later, and Figure 4, Plate 18, shows plainly that the stones were set right over old stampings. The Navahos are demanding more turquoise in their jewelry of late years, and are adding it to old pieces whenever they can.

In the lower right hand corner of Plate 18, the steps for soldering the end piece are shown. The side piece is first soldered to the top in much the same way that a bezel is soldered to a base. The top is cut to the correct shape, then laid face down on the charcoal block and the side piece, bent to shape, is soldered down on it with the solder snippets placed inside. The back is cut slightly larger except for the part which has the two prongs for securing it to the strap. The lower sketch shows the assembly ready for the last soldering. Then the edges are cut or filed off and finished.

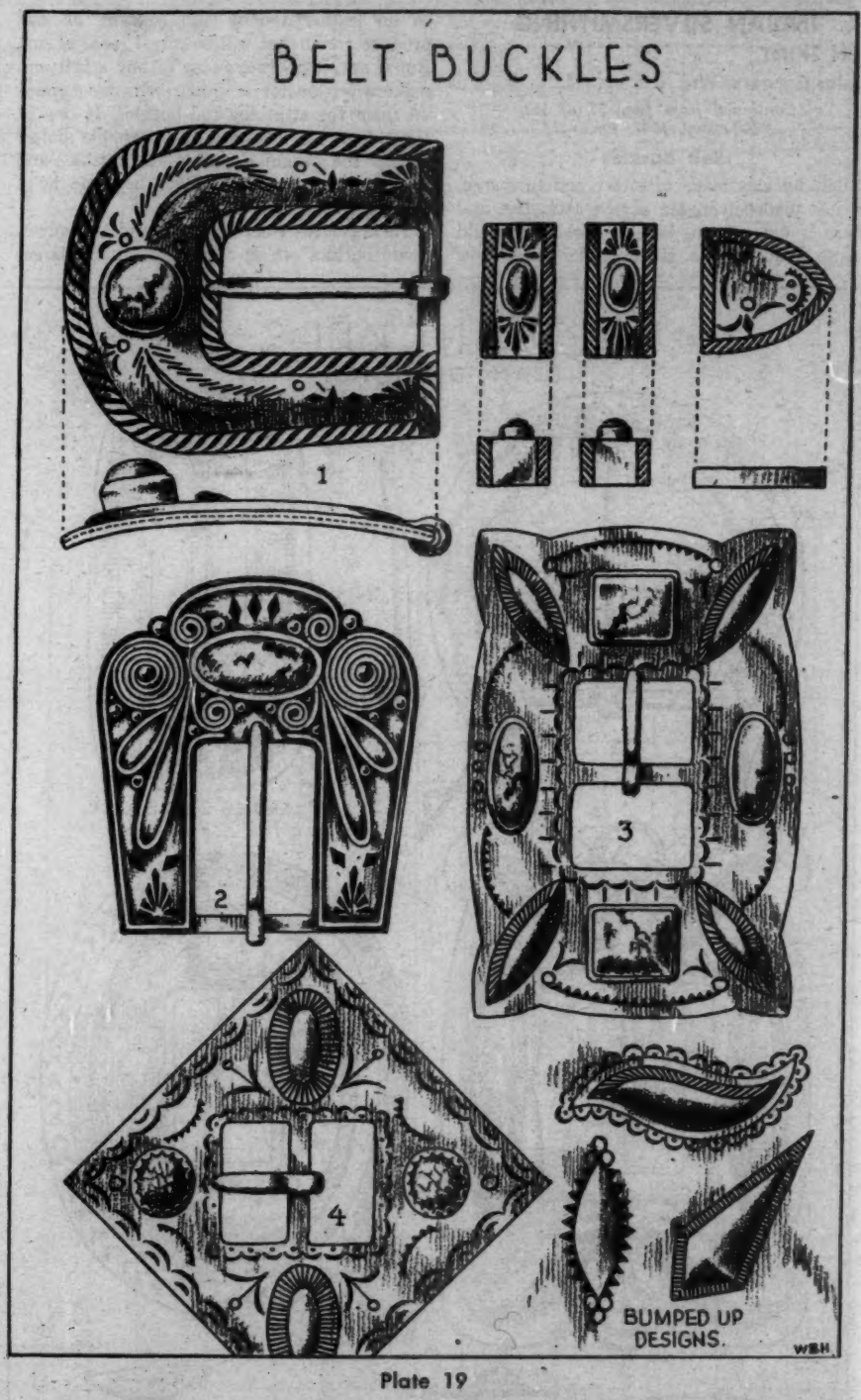


Plate 19

TIMING THE JOB

B. J. STERN

Vocational School Division

New York City

For the past two years I have been carrying on a series of industrial and occupational surveys for the vocational school division of the New York City school system. These studies, embracing the industries of the city, have naturally brought me into contact with employers and managerial executives in all sorts of occupations and I have had a unique opportunity to see and judge vocational education from their particular points of view which often enough do not coincide with the viewpoints of professional educators. There are many interesting facets to this but in this article I will confine myself to one thought which I have expressed by many employers and especially by those in the service occupations such as the automotive trades, beauty culture, and the like.

These trades depend for their profits upon the amount of work that can be turned out in a given time by its artisans. In servicing automobiles, for instance, labor costs to the buyer are standardized for all types of jobs, in rate books used throughout the industry. In these books, hourly labor rates are set, weighted and based upon the amount of work that can be turned out by a good mechanic working under average conditions and in certain localities. The same is fundamentally true of any industry which by experience knows how much work must be done by each mechanic if a profit is to be made.

Now this is a hard, cold fact that must be reckoned with by all who engage in productive labor whether the final product be raw or manufactured goods or service of some kind. Yet, if we are to believe the testimony of the executives I have mentioned, this fact seems to be ignored by those who set the patterns of vocational education. Only too often, it

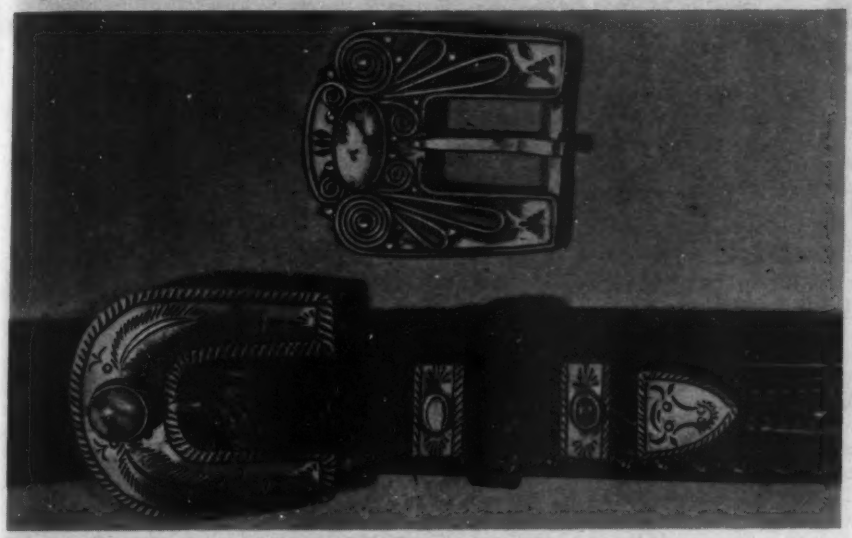


Fig. 6. Finished buckles

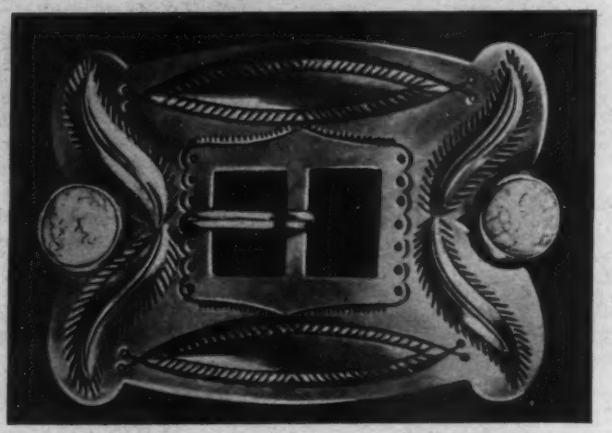


Fig. 8. Buckle similar to the one shown in Fig. 3, Plate 18

seems, the aspiring mechanic comes to his first industrial job without having any definite ideas of the economics or practices of job timing so that while he might be equipped with the fundamentals of his trade practices, he still is an economic loss to his employer until he learns by hard and sometimes brutal experience how to pace his work. Few employers, especially in highly competitive lines, can afford to keep an artisan with the average schoolboys' leisurely approach to his job.

It can be argued, of course, that our vocational schools are not set up to turn out full fledged journeymen mechanics. After all, these schools being but another approach to the problem of the best possible method of educating certain of our children, cannot do more than set the youngsters' feet upon the right road to a future of good citizenship based upon economic independence by the practice of a skilled trade. But the premises upon which our vocational schools are based also does obligate them to give definite and serious trade training in these skilled occupations so that this aim can be realized. If then this vocational training is deficient in any important respect, this deficiency must be recognized and remedied. Certainly any fault that seems to render a graduate of a vocational school unemployable in his chosen field, is one that must be given due and serious consideration. Furthermore, if this graduate can be spared any of the unnecessary pains of adjustment by the addition of certain attitudes about job timing in his school course, then certainly this also should be given consideration.

It is proposed, therefore, that in the last year of any definite course of trade training, such as automobile mechanics, mechanical drafting, etc., the courses of study be arranged with time limits set for the satisfactory completion of each particular job, whether it be an engine tune up, the making of assembly and detailed drawings of a mechanism or structure, the making and assembly of the parts of some tool, or the producing of some project in the machine shop. Of course, these time limits must be set with due thought to the immaturity of the schoolboy mechanic and weighted in proportion to commercial timing. In this way, if the program be enforced with efficiency, our vocational school graduates will have at least made a beginning at economic job pacing, and will have at least a working knowledge of what industry expects of its workers in the way of output. Furthermore, the discipline imposed by living up to these time limits should do much to cure schoolboy dawdling, fumbling, and other time consuming habits.

6-VOLT SOLDERING IRON

A. W. DRAGOO

Assistant Professor of Industrial Arts

Illinois State Normal University

Normal, Ill.

The soldering iron described here is primarily an "emergency" tool. It was designed to operate from a 6-volt storage battery and in tests it has reached soldering heat in 30 to 45 seconds. This iron is light in weight and small enough to be placed in the glove compartment of a car. It will be found to be particularly useful at times when a source of soldering heat is necessary and the only source of power available is that produced by an automobile storage battery. Construction is simple and rugged. The operation of this iron is even more simple.

To use the iron, the tip is placed against the joint or splice to be soldered and the trigger is pressed. In a matter of seconds the tip will be hot enough to melt solder. The joint or splice is then soldered in the conventional way.

The action of the iron is very dependable. The cable clips are clipped to the posts of the battery. When soldering is to be done, the trigger is squeezed causing the carbon element to be forced up into the tip where the end of the element makes contact with the end of the hole drilled in the tip, thus completing the circuit. The current passes up one of the cable leads to the carbon holder, through the carbon element, to the soldering tip, through the frame, and back to the battery through the other cable lead which is grounded to the frame by means of one of the machine screws which secures the handle to the frame.

Construction

Soldering tip. The tip may be turned out of copper bar stock or the tip from a cheap soldering iron may be utilized. If the tip used is of any other dimensions with respect to outside diameter than the one specified, slight alterations will have to be made in the frame at the point that wraps around and secures the tip to the frame.

Mica insulator. The insulator is cut from sheet mica. It must provide snug bearing surface for the carbon element and at the same time insulate it from the tip. The dimensions of this item will vary according to the size tip and element used. If the dimensions on the plans are adhered to, this piece will be a rectangle measuring 1 3/16 by 1 5/8 in.

Carbon element. The carbon element can

be made from the positive element of an ordinary flashlight cell or may be turned down from the positive element of a No. 6 dry cell.

Carbon holder. The carbon holder is made from a 1-in. length of ⅜ in. O.D. copper tubing. Measure off ½ in. on the copper tubing and clamp it at this point in a vise. Now by tightening up the handle of the vise, the flat portion of the carbon holder will be formed. This portion has two ⅛-in. holes drilled in it. One hole to receive the ¼-in. 5–40 trigger link bolt and the other to receive a ¼-in. 5–40 bolt for fastening one of the cable leads to the element holder. It is finished by filing off the square corners on the flattened portion. The carbon element is then pressed into the ¼-in. hole on the other end.

Trigger link. The trigger link may be made of thin tin plate such as that found in a tin can.

Trigger. The trigger may be made of wood, fiberboard, plastic, or similar material.

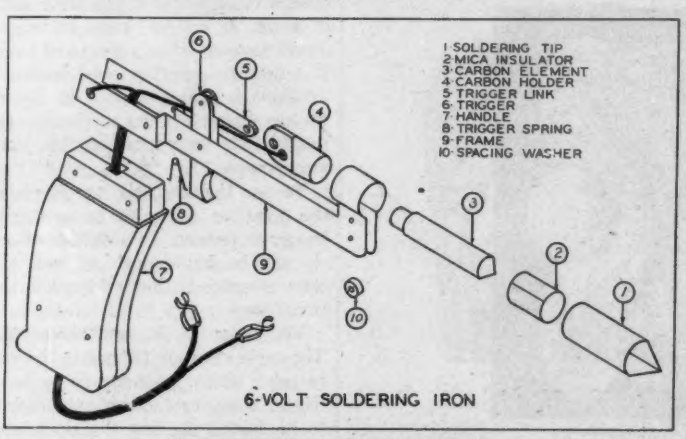
Handle. The handle may be made of wood, fiberboard, plastic, or similar material. It is made in two halves with a groove cut longitudinally to receive the battery cable. The halves are held together by four 1-in. 5–40 machine bolts. The top two bolts serve to secure the handle to the frame.

Trigger spring. The trigger spring may be fabricated of .065-in. piano wire or a large safety pin may be utilized by cutting off the snap.

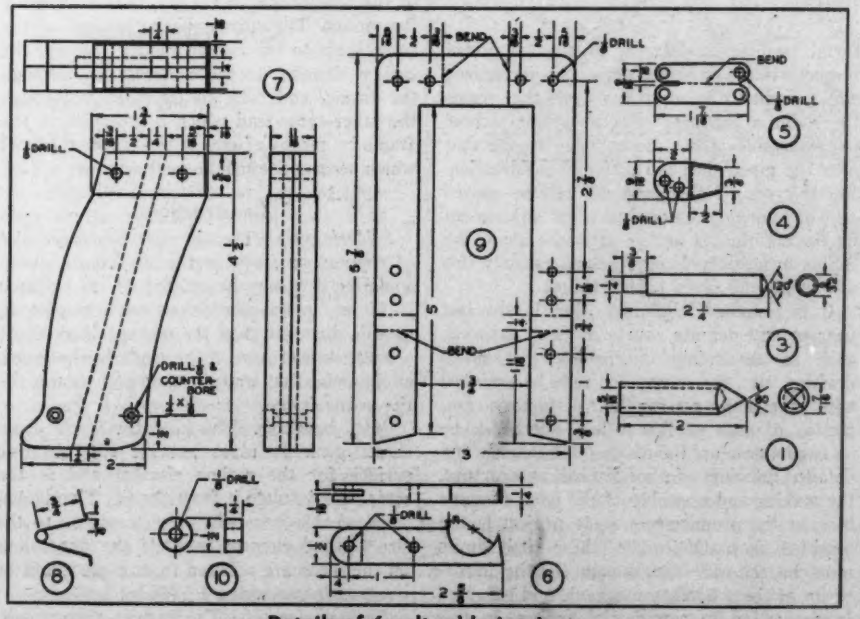
Frame. The frame may be made of 16-gauge galvanized sheet metal or similar gauge sheet metal. It may be finished off with a coat or two of heat resisting enamel.

Spacing washer. The spacing washer may be made of wood, fiberboard, or similar material which is relatively unaffected by heat. Asbestos board also may be used.

The different parts of the soldering iron are assembled to the frame with ¼-in. 5–40 machine bolts. The cable is run up through the hole in the handle; one lead is grounded to the frame and the other lead is bolted to the carbon element holder by a ¼-in. 5–40 machine bolt.



Assembly of 6-volt soldering iron



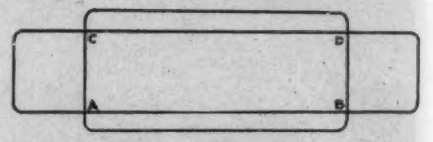
Details of 6-volt soldering iron

HOW TO MAKE A PENCIL TRAY

MARTIN PETERSON
Cincinnati, Ohio

This is an attractive desk tray for pencils. Read all of the directions before attempting to do item No. 1.

1. Draw the size of the bottom of the tray, 2¾ by 7½ in., on pattern paper.



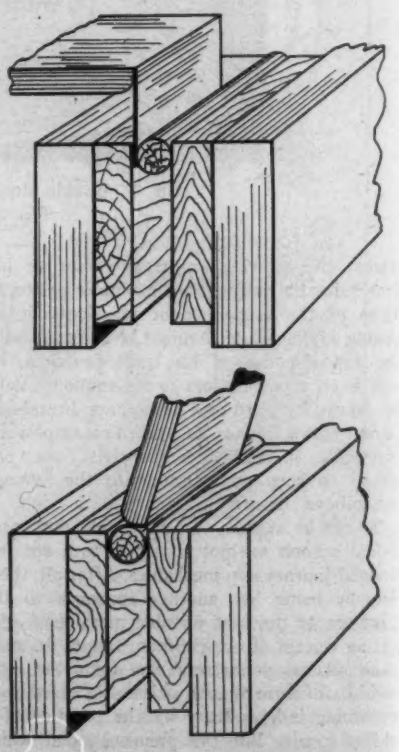
2. Add the width of the ½-in. sides of the tray to both sides of the bottom.

3. Draw a side view of the rounded end of the tray. This is a ¾-in. circle.

4. By stepping off, along the circumference, distances of ¼ in., determine the length of metal required. Subtract ¼ in. from this amount because the circle does not close.

5. Add the stepped off distance found in No. 4 to both ends of the tray.

6. With a scale, measure the total width and total length of the pattern.



7. Obtain a piece of metal this size.

8. Redraw the lines directly on the sheet metal, using a pencil gauge and try square for accuracy.

9. With a sharp pencil compass, draw round corners.

10. With a tin snips cut along the lines accurately. Your metal will look like this layout.

11. Lay edge AB along an iron edge of a bench and bend at a right angle. Tap lightly with a wooden mallet.

12. Likewise bend an edge at CD.

13. Bend right angles at AC and BD.

14. Using a ¾-in. dowel stick, place the tray in position in a vise, as shown and bend. Two or more settings in the vise may be necessary to make the rounded edge.

15. Polish with steel wool. Use emery cloth on edges when necessary.

BEVERAGE CART

ISADORE M. FENN

Chicago, Ill.

This project needs very little motivation. It is simple to construct, yet teaches a number of the fundamental tool operations.

Students will go to work on this pleasant job in a happy frame of mind, of course, with the thought of presenting it to their parents, and parents are pleased to receive this novel and practical gift when made by their boy.

Steps in Construction

1. Read and become familiar with the blueprint.

2. Obtain two pieces of plywood for the top and bottom.

3. Square up these two pieces to the proper dimensions.

4. Lay out the edge, end design, and holes for the glasses. (Students should obtain measurements of the small glasses which they are going to use so that the glasses will fit the holes. Average size is between 2 and 2¼ in.)

5. Cut out the holes, edge, and end design.

6. Use dowel rods for the seven supports.

7. Cut out the wheels and use a dowel to connect them.

8. Square up a piece of wood for the axle and handle. Shape the handle according to the drawing.

9. Sandpaper and assemble all the parts. Attach with nails and glue, or screws and glue.

10. Finish natural or in colors.

Experiences in Construction

1. Reading and understanding blueprints, following directions.

2. Obtaining material, measuring.

3. Using a plane, try square, marking gauge, dividers, rule, laying out and squaring material.

4. Using the crosscut saw, ripsaw, and cutting out the holes, edge, end design, handle, and wheels, with the use of the jig saw.

5. Using the backsaw or miter saw to cut the dowel rods for supports.

6. Using the brace and bit for boring the holes in the wheels and axle.

7. Using sandpaper, sandpapering block, and assembling with nails, screws, and glue.

8. Finishing — using stain, shellac, or varnish, or paint.

BOOK RACK

ROLLAND A. HOEHN, JR.

Junior High School

East St. Louis, Ill.

The making of this combination book rack and pencil holder gives the junior high school student an opportunity to acquaint himself with some of the fundamental techniques in mechanical drawing as well as in woodwork.

Book rack

Appealing to the average student of this age group, the drawing and photograph both suggest a modern design.

The procedure for making the book rack is as follows:

Base:

1. Scribe, mark, and saw out base from any suitable hard or softwood.

2. Drill ¼-in. holes to accommodate No. 10 by 3-in. f.h. screws, as per illustration.

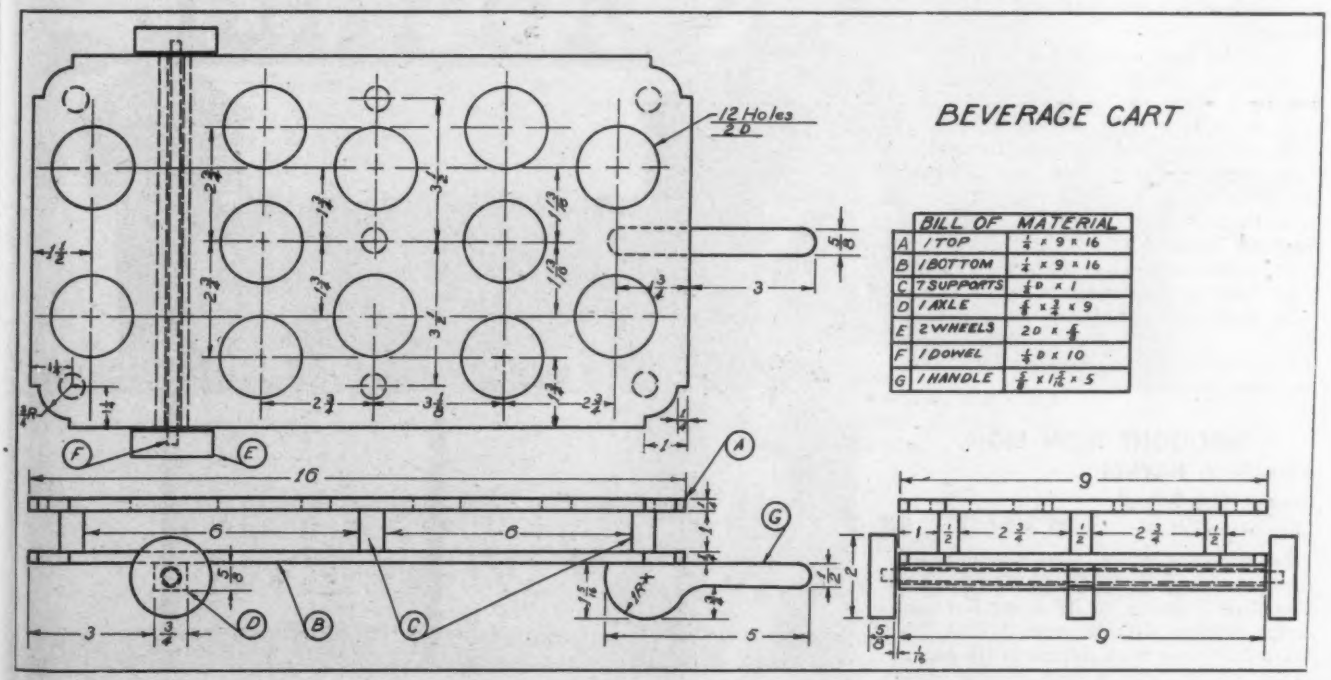
3. File, plane, and sand thoroughly.

Sides:

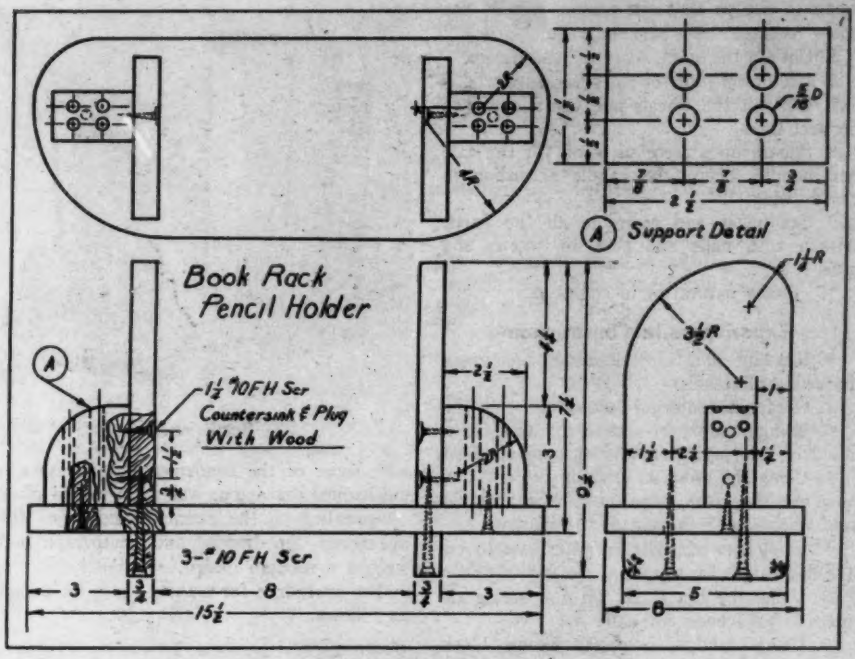
4. Scribe, mark, and saw out sides.

5. Drill ⅛-in. holes in bottom edge to secure 3-in. No. 10 screws.

6. Drill ¼-in. holes and countersink through sides to accommodate No. 10 by 1¼-in. screws.


BEVERAGE CART
12 Holes 2D
BILL OF MATERIAL
A 1 TOP ¼ x 9 x 16
B 1 BOTTOM ¼ x 9 x 16
C 7 SUPPORTS ½ D x 1
D 1 AXLE ⅝ x ¾ x 9
E 2 WHEELS 20 x ⅝
F 1 DOWEL ½ D x 10
G 1 HANDLE ⅝ x 1⅞ x 5

Beverage Cart



Details of book rack

7. File curved edges, plane surfaces, and sandpaper thoroughly.

Feet:

8. Scribe, saw out, and smooth.

9. Drill ¼-in. holes and countersink to accommodate No. 10 by 3-in. screws, as per drawing.

10. Assemble (temporarily) by driving 1½-in. finishing nails into feet, through the base and into the bottom edge of the sides.

11. Insert No. 10 by 3-in. screws through feet and base, and drive into sides.

Support:

12. Scribe, mark, and saw out.

13. Locate, and drill 5/16-in. holes, as per drawing.

14. Scribe ¼-in. radius and saw out.

15. File, plane, and sandpaper thoroughly.

16. Locate and drill guide holes to secure No. 10 by 1¼-in. flathead screws.

17. Fasten support to rack.

Suggested finish:

18. Smooth with fine sandpaper.

19. Apply oil stain and wipe dry.

20. Apply one coat of shellac and allow to dry.

21. Smooth with fine steel wool and apply two coats of wax.

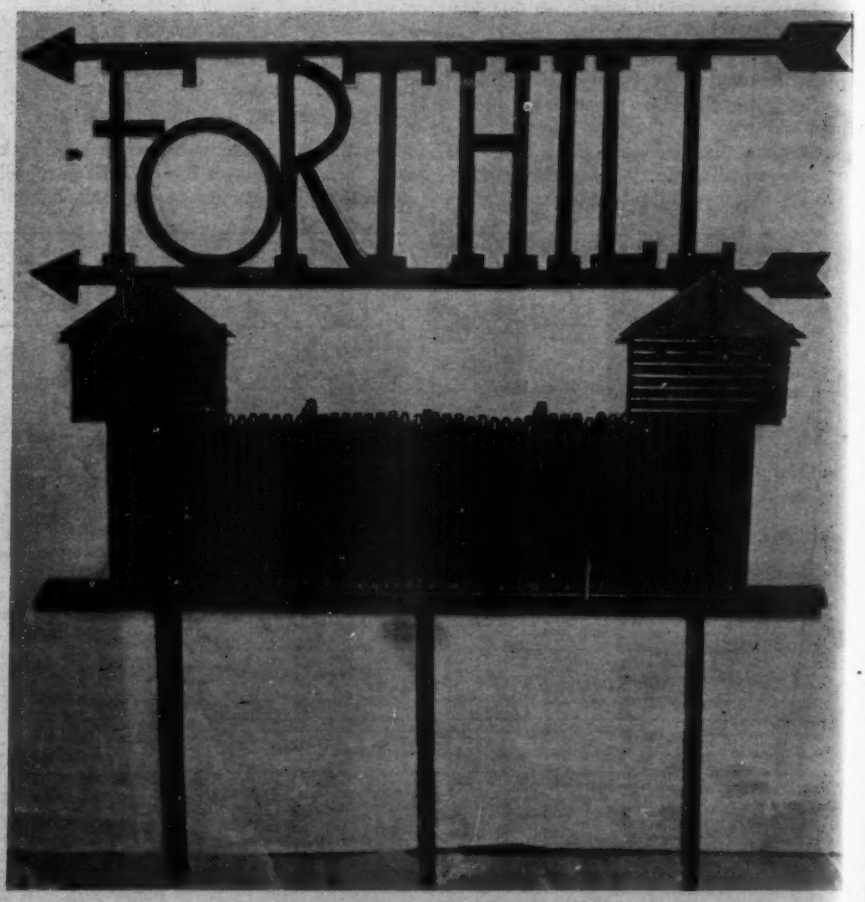
WROUGHT IRON SIGN

ARTHUR V. HAYNES
Garnet High School
Charleston, W. Va.

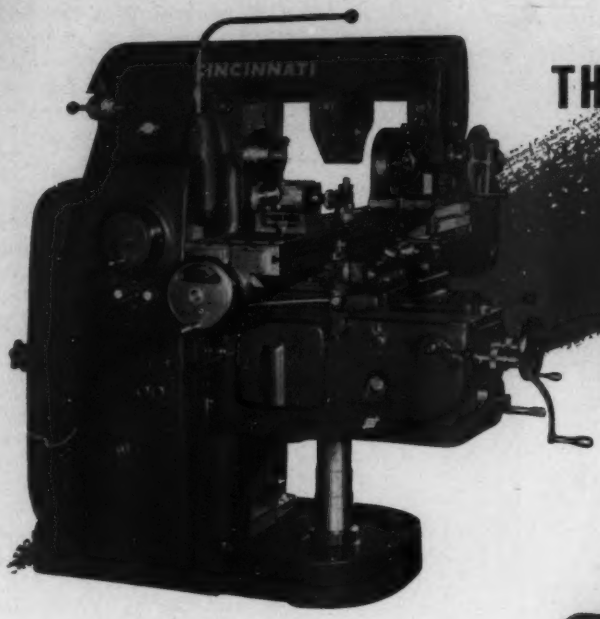
In Charleston, W. Va., there is an historical spot tied in with the history of West Virginia. The place is known for its strong fort used during the days of Indian wars. A local club, which has shown much interest in the preservation of this tract of land, recently called upon our general metals class to design and construct a sign which would last through the years. It was requested that the Fort be included with the lettering needed to guide observers to the place. After drafting several plans our class finally worked out one which told the story very well.

A full-size drawing was used for a pattern. The size of the drawing was 24 by 32 in., done on white cardboard in black ink. Half inch square iron was used for the lettering and arrows. The arrowheads were cut from ½-in. plate and filed to the proper shape. The lettering was made by cutting stock to match the drawing. Each letter was made separately. They are 7½ in. high. The parts were welded on the back and they were finished with a portable grinder. After placing each letter in place, they were welded on the long pieces forming the arrows. The arrowheads were welded on and finished. For the logs in the fort, 7/16-in. round iron was used. The upright pieces were cut 7 in. long with exception of two pieces for the gate posts which were 7½ in. long. The gun turrets were made from similar stock and a 6½-in. length was used. Two pieces for the roof tops were cut from 3/16-in. plate and filed to shape. These pieces were hammered with a ball-peen

(Continued on page 18A)



Wrought iron sign



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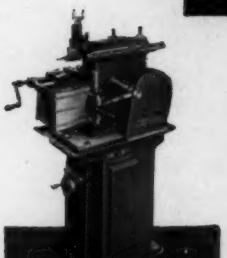

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(Continued from page 136)

hammer to produce the desired effect. All of this section was also welded on the back with an arc welder. The holes for the gun positions in the turrets were drilled and filed to shape. The lettering section and the fort section were welded together, being supported by a brace extending from top to bottom. One brace for each side was used running behind the letters L and F. Since the sign was to be installed in a rock mound it was necessary to build a base with prongs facilitating the mounting. A piece of iron ½ by 1½ by 32 in. was welded at the bottom of the sign for this purpose. To this was added three pieces of the same stock 10 in. long. These were welded on all sides underneath the base of the sign.

The entire project, when finished, was cleaned with emery cloth and then a first coat of red lead was applied. Black enamel was used for the second coat.

AIRCRAFT FUEL AND OIL SYSTEMS TEST

WALTER M. GORDON and WILLIAM C. FORD
Aero Acres
Baltimore, Md.

General directions: Read each question carefully and answer as directed at the beginning of each part. This is not a test to see how fast you can work; it is a test to see how much you know. If you do not know the answer to a question, do not spend too much time on it; proceed to the next questions, and then to the next part. No questions will be answered after the examination begins. Are there any questions now? If not, begin.

Part I

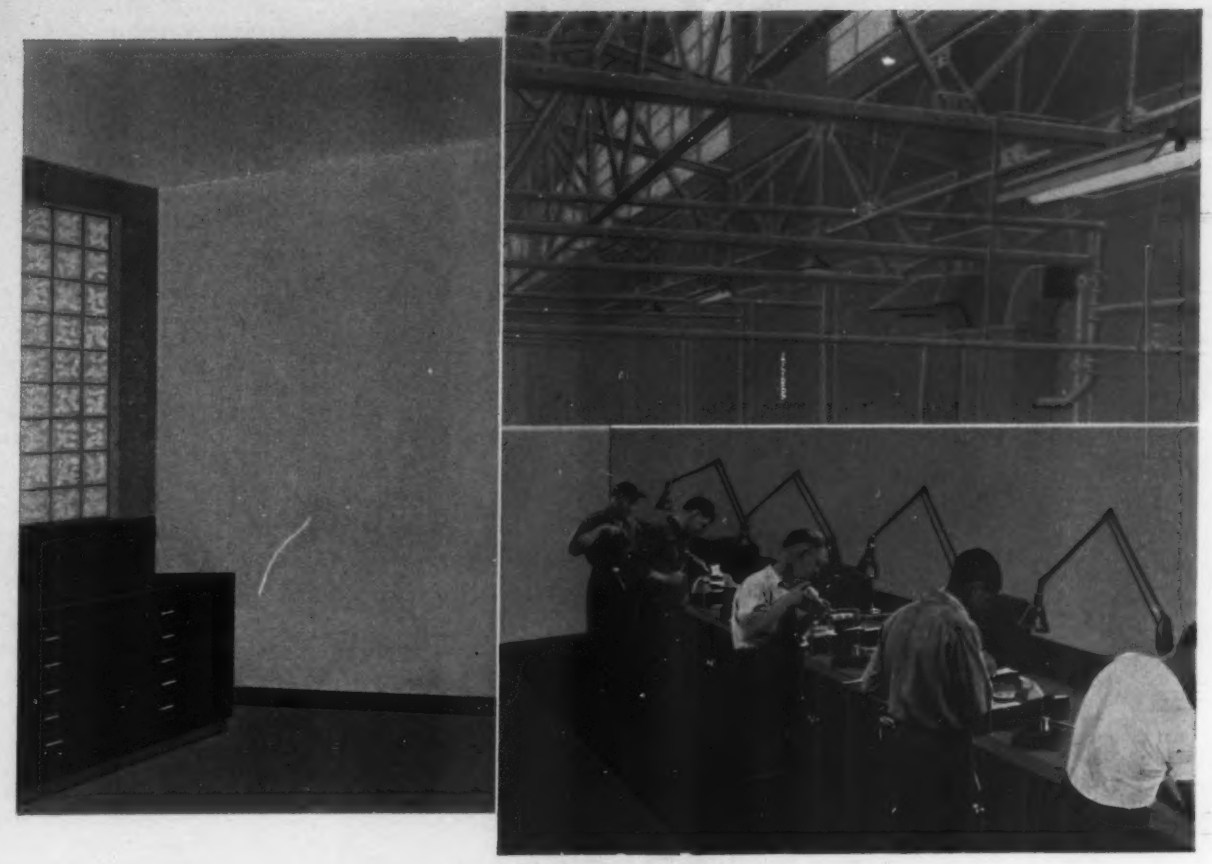
Directions: Some of the following statements are true, and some are false. In each case write *T* on the left of the statement if you think it is true, or write *F* on the left if you think the statement is false.

( ) 1. Gravity feed fuel systems are used on airplane engines having less than seven cylinders and developing under 100 horsepower.
( ) 2. The fuel tank vent line permits an increase in pressure on the fuel in the tank.
( ) 3. Fuel lines are constructed of copper or aluminum alloy tubing.
( ) 4. Most modern fuel systems, especially on large airplanes, make use of vane type fuel pumps.
( ) 5. Inverted flight of an airplane over a long period of time is made possible by use of a gravity feed fuel system.
( ) 6. The fuel pressure gauge on the instrument panel is connected in the line between strainer and pump.
( ) 7. The function of a fuel system is to mix fuel and air.
( ) 8. A wobble pump may be used to pump fuel from a lower tank to higher level gravity tank.
( ) 9. The fuel shut-off valve is controlled from the pilot's cockpit.
( ) 10. Oil lines are constructed of stainless steel.
( ) 11. Oil lines are painted with a band of red paint near each end for identification purposes.
( ) 12. Engine scavenging pumps return oil from the engine oil sump to the oil supply tank through the temperature regulator.
( ) 13. Oil tank vent lines always vent overboard.
( ) 14. No expansion space is required in most oil supply tanks.
( ) 15. Dilution of oil permits easier starting in cold weather.
( ) 16. Oil pressure pumps are installed in oil systems to pump oil from the tanks to the engines.
( ) 17. Oil tanks are usually constructed of aluminum alloy or stainless steel.
( ) 18. The purpose of an oil tank drain cock is to drain the oil system.
( ) 19. The oil pressure gauge on the instrument panel is connected to the oil temperature regulator.
( ) 20. Baffle plates are used in fuel and oil tanks to prevent foreign matter from entering the tanks.

Part II

Directions: The following are sentences with missing words or phrases. Fill in the

(Continued on page 21A)



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(Continued from page 18A)

blanks with the correct words or phrases necessary to complete each sentence.

1. The purpose of a main line fuel strainer is to .....
2. Two types of wing fuel tanks are ..... and .....
3. The ..... type fuel system is better suited to high-powered engines.
4. Baffles in fuel tanks are for the purpose of ..... and to .....
5. Two types of engine driven fuel pumps are ..... and .....
6. The function of a bypass valve in a fuel system is .....
7. Fuel indicators, usually located in the cockpit, are for the purpose of .....
8. Fuel tanks are usually constructed of ....., ... or .....
9. The major units of an oiling (lubrication) system are ....., ..., ... and .....
10. Oil dilution system is operated manually by controls located .....
11. Oil may be drained from the oil temperature regulator and cooler by .....
12. Upon starting an airplane engine, the oil pressure is generally very high due to .....

Part III

Directions: The meaning or association of the words in the numbered items, are to be found in the lower list. In the space to the left of each number write the letter from the lower list which explains the meaning or association of that particular word.

1. engine driven fuel pump
2. high octane gasoline
3. use of inferior fuel
4. lubricant
5. auxiliary fuel pump
6. tank hopper
7. octane rating
8. fuel cock
9. viscosity
10. main strainers

a) designates antiknock value of a fuel mixture in an engine cylinder
b) permits engine oil to warm more rapidly after engine has started operating
c) draws fuel from tank and forces it to carburetor
d) prevents dirt and other foreign matter from entering pump and carburetor
e) delivers fuel to engine in case engine driven fuel pump fails to function
f) makes it possible to get more power from the engine, especially at take-off
g) may result in severe detonation
h) a substance with greasy properties used for reducing friction and preventing rust
i) serve as tank selectors, engine selectors, crossfeed valves, and the like
j) term used to express flow resistance of a fluid
k) furnishes oil by gravity to the fuel system
l) term used in the treatment of a lubricant with sulphuric acid

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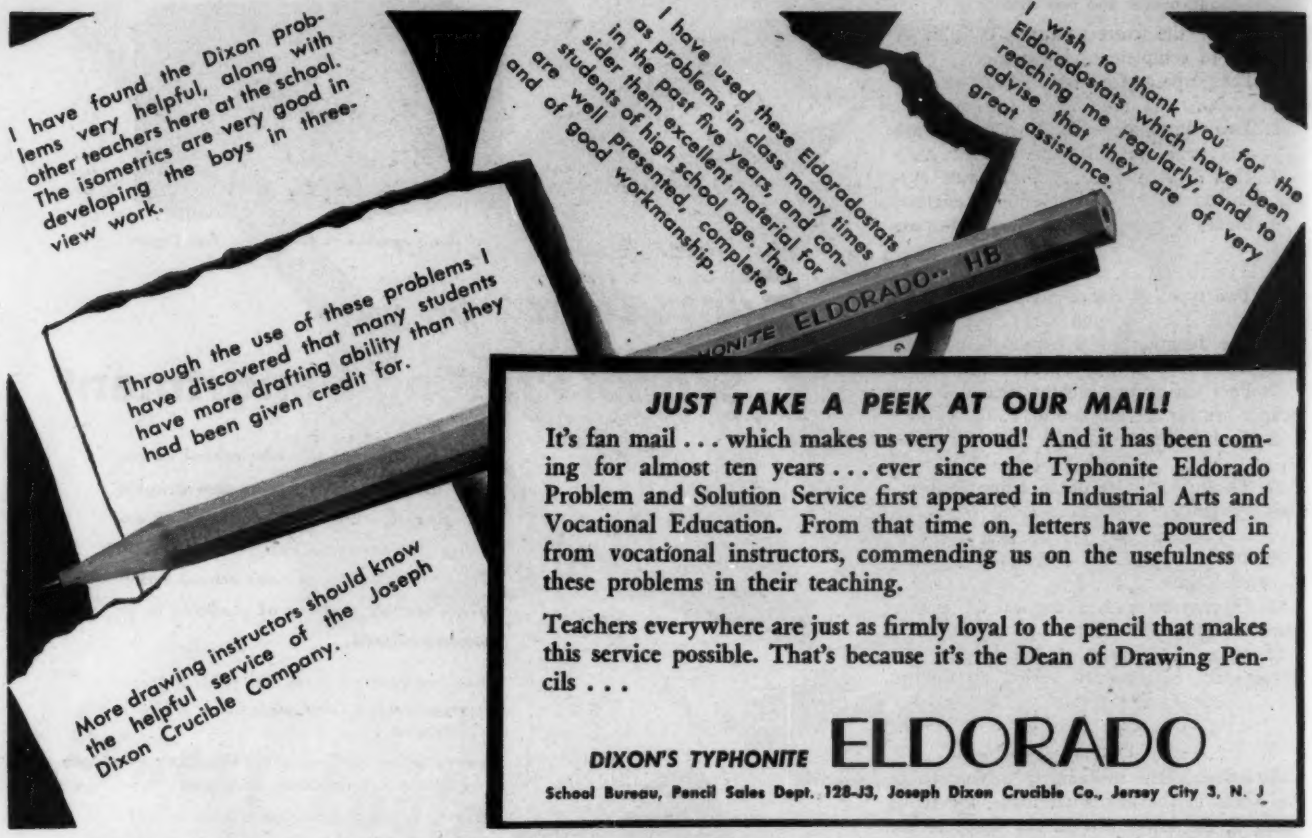
Part IV

Directions: Each incomplete sentence is followed by a group of words or phrases. Underline the correct words or phrases following each sentence which will complete that sentence.

1. The base from which aviation fuel is derived is:
   a) kerosene
   b) asphalt
   c) petroleum
   d) castor oil
2. Water can be detected in gasoline because it
   a) is lighter than gasoline
   b) mixes readily
   c) settles to the bottom
   d) rises to the top
3. The main line or master fuel strainer is always located
   a) at the lowest point in the fuel system
   b) at the highest point in the fuel system
   c) anywhere between lowest and highest point in the fuel system
   d) next to the carburetor
4. Color coding for fuel lines is
   a) red
   b) yellow
   c) white
   d) brown
5. Color coding for oil lines is
   a) red
   b) yellow
   c) white
   d) brown
6. Fuel for the primer
   a) must be taken from one of the strainers
   b) always comes from a ¼-in. line from a wing tank

(Continued on next page)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(Continued from page 21A)

c) usually comes from upper cylinders
d) may be supplied from almost any point in the fuel system

7. Fuel pumps used in most aircraft fuel systems are
a) hand operated
b) hydraulically operated
c) electrically driven
d) engine driven

8. An oil radiator, or cooler, is for the purpose of
a) storing reserve supply of oil
b) maintaining desired oil temperature
c) diluting the oil system
d) relieving pressure on oil supply tank

9. Engine oil pumps are for the purpose of
a) pumping small amounts of oil to the carburetor
b) pumping oil from the oil supply tank to engine
c) pumping oil from radiator to engine
d) circulating oil to working parts of engine and to scavenge engine of surplus oil

10. When a cold engine is first started, oil circulation is
a) very slow
b) about normal
c) little above normal
d) very fast

KEY AND SUGGESTED SCORING

Part I (one point each)

1. T	3. T	5. F	7. F	9. T
2. F	4. T	6. F	8. T	10. F
11. F	13. F	15. T	17. T	19. F
12. T	14. F	16. F	18. T	20. F

Part II (two points each)

1. to remove solid particles from the fuel
2. integral, bladder cell
3. pressure
4. reinforcing the tank, eliminate surging of fuel
5. gear type, vane type
6. to bypass fuel around the fuel pump
7. indicating function of fuel system
8. aluminum, aluminum alloy, stainless steel (also, synthetic rubber)
9. oil tank, oil temperature regulator and cooler, oil temperature gauge, oil pressure gauge
10. in the cockpit (or flight engineer's panel)
11. a plug located in lowest point of the assembly
12. high viscosity of the oil

Part III (two points each)

1. *c*	3. *g*	5. *e*	7. *a*	9. *j*
2. *f*	4. *h*	6. *b*	8. *i*	10. *d*

Part IV (two points each)

1. *c*	3. *a*	5. *b*	7. *d*	9. *d*
2. *c*	4. *a*	6. *d*	8. *b*	10. *a*

TEST ON THE ELEMENTARY PRINCIPLES OF JET PROPULSION

WALTER G. HJERTSTEDT
Lane Technical School
Chicago, Ill.

Jet propulsion is the new term applied to the force of the latest type of aircraft motor which far surpasses the power of the old reciprocating engine in speed. Although the jet propelled motor has less than one tenth as many parts as the ordinary airplane or reciprocating engine, the jet propelled motor creates more thrust than the largest airplane reciprocating engine. The power of jet propulsion is measured in terms of thrust instead of horsepower.

The technical name for a jet-propelled motor is reaction motor and operates upon Sir Isaac Newton's third law of motion, namely, that for every force or action there is an equal and opposite reaction. His other two laws of motion which also apply are:

1. A body at rest or moving with uniform velocity continues so to move forever unless a force acts upon it.

2. If a force is applied to a body the body acquires an acceleration in the direction in which the force acts and proportional in magnitude to it.

In 1680 Sir Isaac Newton built a model of a jet-propelled horseless carriage.

Rockets and jet-propelled planes with swept-back wings are built in some of the strangest forms conceived by man. They operate on the simple principle of high velocity, air or gas jets being expelled from the rear of the motor and the reactive forces exerting a thrust or push upon the rocket or plane, thus sending the rocket or plane forward. A simple example is an ordinary toy balloon open at one end filled with air and let loose.

Jet propulsion may be divided into two groups, one air-free and the other self-contained as to fuel and oxygen, the latter using no air from the earth's atmosphere. The air-free type operates on a simple difference of

(Continued on page 24A)

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(Continued from page 22A)

momentum between the inrushing air at the front of the motor and the heated, outrushing, high velocity air at the tail. This type of jet-propelled plane carries its own fuel but takes oxygen from the air as it travels through it. Theoretically, it would be impossible to construct a rocket to the moon of this type as it could not be supplied with oxygen beyond the earth's atmosphere. The latter operates as a pure rocket similar to the ordinary Fourth of July skyrocket which is as old as the history of China.

Jet-propelled planes are very smooth and comfortable to ride in and can fly from ten to twenty thousand feet higher than an ordinary plane with reciprocating engine and propeller. There is no vibration and the only noise is the sound of the air which rushes over the plane's swept-back wings. When supersonic speeds are reached air particles pile up in front of the plane faster than they can fly around it, forming a shock wave. Therefore, jet-propelled rockets operate to better advantage beyond the earth's atmosphere where there is no friction due to air particles. A jet-propelled motor uses cheaper fuel oils than the reciprocating engine.

Supersonic planes or planes which are to fly faster than sound must be propelled by other means than a propeller and jet propulsion is undoubtedly the solution. The speed limit of the propeller type of plane with reciprocating motor until recently was placed at 400 miles per hour when the P-47 broke this record and developed a speed of 500 miles per hour. However, the efficiency of the propeller decreased to 80 per cent. It may be possible to design a propeller which will develop a speed of 600 miles per hour but that is undoubtedly the limit.

During World War II Germany was farther advanced in jet propulsion than the United States and at present we lag behind England who has recently announced that her total engineering resources will be used in the development of jet propulsion and the reaction motor.

Jet-propelled planes will undoubtedly some day fly above the earth's atmosphere at inconceivable speeds and in the not too distant future travel at supersonic speeds which will bring any point on the earth's surface within a day's flying time.

Objectives

1. To test the students' knowledge of the fundamental and elementary principles of jet propulsion.

2. To test the students' vocabulary and knowledge of the terms as applied to jet propulsion.

3. To discover the correlation existing between industrial arts and the study of jet propulsion.

4. To find out how to adjust the content of the industrial-arts program to the science of jet propulsion.

5. To find out how to enrich and vitalize the industrial-arts program by introducing selected material from the science of jet propulsion.

6. To capitalize upon the natural interests of the student and to encourage him to become more conscious of the underlying principles of jet propulsion.

7. To discover in the student, endowments which might well be capitalized, and abilities which should be recognized and cultivated.

8. To compare attainment with ability and capacity to attain so as to guide learning into channels best suited for each individual student.

9. To be able to provide better educational and vocational guidance and to plan suitable training intelligently.

10. To understand and guide the student better and to test his abilities and interests.

Scoring the test: To get the total raw score for the complete test add the individual raw scores found at the end of Parts I, II, III, IV, V, VI, and VII respectively.

Raw score for Part I .....
Part II .....
Part III .....
Part IV .....
Part V .....
Part VI .....
Part VII .....

Total raw score or total number of questions answered correctly for complete test.....

General directions: The aim of this test is to give you an opportunity to show what you have learned from your study of jet propulsion. It is not expected that you will be able to answer every question. Read the directions and every statement carefully and be sure you understand what you are to do before you begin.

Part I

Specific directions to the student: Some of the following statements are true and some are false. Read each statement carefully. If the statement is true, place a *T* in the parentheses before the statement, as in items 1 and 3. If the statement is false, place an *F* in the parentheses, as in items 2, 4, and 5. You will not be penalized for statements incorrectly marked.

Example:

(T) 1. Whether a rocket is in ordinary atmosphere or in a vacuum a forward thrust is created.
(F) 2. Early in 1945 there were at least a half-dozen large high-speed wind tunnels in use in the United States.
(T) 3. A rocket is propelled in the same way that a jet plane is driven.
(F) 4. The propeller is very essential in jet propulsion.
(F) 5. One of the earliest types of jet-propelled motors was the ramjet.

( ) 1. Since 1946 the United States has held the world's speed record of 606 miles per hour set by the Gloster Meteor.
( ) 2. The value of extreme thrust produced by a jet-propelled motor is lost if it is installed in the conventional airplane.
( ) 3. The speed of the V-2 rocket is approximately a mile a second.
( ) 4. The exact speed of rockets has been

(Continued on page 26A)

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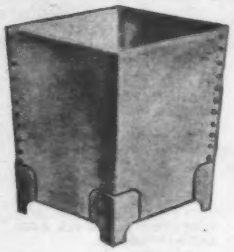

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1. What aluminum wrought alloys are best for school use? Answer: Commercially pure aluminum, 2S; the aluminum manganese alloy, 3S; and the aluminum-magnesium-chromium alloy, 52S.
2. How should aluminum sheet be protected during sawing and filing? Answer: It should be covered with paper applied with a pyroxylin adhesive or with Scotch tape.
3. How is the satin finish applied to aluminum projects? Answer: Rub the surface with No. 000 steel wool and furniture wax.
4. What etching solution is reasonably safe for school use? Answer: 2 ounces of hydrochloric acid, 8 ounces of water, and ½ teaspoon of copper sulphate crystals.

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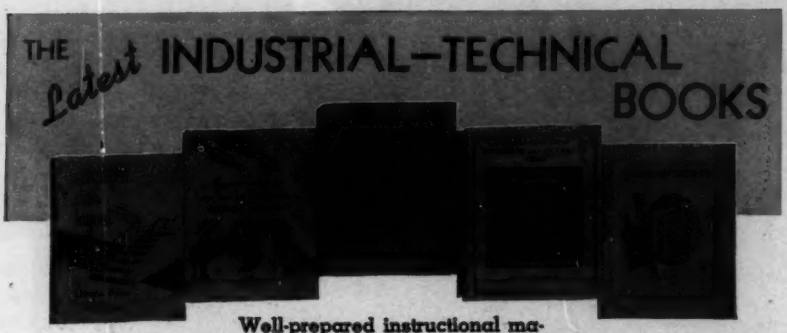

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(Continued from page 24A)

sufficiently timed to give accurate estimates of the length of time it would take for a rocket to travel from the United States to Europe.

( ) 5. The tiny XS11 plane made by the army air forces and Bell Aircraft Corporation was designed to fly 1700 miles per hour.

( ) 6. The General Electric Company is now deep in the development of jet motors.

( ) 7. Thermal-jet motors operate on the principle that a motor produces rotary motion in a shaft or wheel.

( ) 8. V-2 rockets travel at the supersonic speed of ten times that of sound.

( ) 9. A rocket motor can operate where there is no air.

( ) 10. The principle of jet propulsion is something new, having been discovered during World War II.

( ) 11. The British Minister of Supply recently announced that all future work on reciprocating engines has been halted to throw the entire empire's engineering resources into the new field of jet propulsion.

( ) 12. A reaction motor jets out a stream of gas at high velocity.

( ) 13. A jet plane uses expensive fuel oils.

( ) 14. The German V-2 rockets have been tested by the United States Army at White Sands, N. Mex.

( ) 15. The jet-propelled plane was used by the United States against Germany during World War II.

( ) 16. The jet motor is very complicated in comparison with the reciprocating engine.

( ) 17. The mutual actions of any two bodies always consist of equal and oppositely directed force.

( ) 18. Jet-propelled planes must carry their own supply of oxygen since they cannot draw it from the air as rockets do.

( ) 19. Germany was ten years ahead of all other nations in the development of high-thrust liquid fuel rockets.

( ) 20. Jet-propelled gliders operate on the principle of a motor that thrusts or pushes.

( ) 21. The United States launched the first pure rocket plane in the world.

( ) 22. The friction of the air particles and speed of the V-2 rocket cause the rocket to become red-hot toward the end of the flight when traveling in comparatively dense atmosphere.

( ) 23. The advantage of a jet-propelled plane lies in its easy maneuverability at extremely high speeds.

( ) 24. At high speeds the fuselage drag of a plane is unimportant.

( ) 25. It is planned that the Megaroc is to be a modified and enlarged version of the German V-2 rocket.

( ) 26. The air of the atmosphere helps to drive a skyrocket upward.

( ) 27. The weight of the fuel now required to sustain long airplane flights is something which will be greatly eliminated when rockets are used for high speed, long distance flying.

( ) 28. In the early part of 1945 the United States had an adequate supersonic wind tunnel.

( ) 29. A heat engine can transform all of the chemical energy of its fuel into useful mechanical energy.

( ) 30. The variable-pitch propeller is so efficient that it is carrying over into gas-turbine development.

Scoring Part I: Raw score or total number of questions answered correctly.

Part II

Specific directions to the student: Some of the statements which follow are true and some are false. Read each statement carefully. The false statements have been falsified by the insertion of an incorrect word instead of a correct word. Underline the word in each false statement which makes the statement incorrect. Letter neatly the correct word in the blank space in front of the statement.

Example:

....four.... 1. A jet-propelled motor consists of ten fundamental parts.

..... 2. The ramjet utilizes the basic processes common to any automobile engine.

..... 3. The General Electric scientists knew the velocity, trajectory, altitude, and range of the V-2 rocket.

..German.. 4. In rockets the United States lags far behind the 58,000 pounds thrust of the British V-2 motor.

Supercharger 5. In 1918 Dr. Sanford Muss

(Continued on page 34A)

More and more Industrial Arts Instructors are specifying Disston Tools for school workshop use. They find that Disston Tools cut faster, stay sharp longer and give extra years of dependable service . . . results that are due to Disston tool-making skill and the fine quality of Disston Steel.

Their use is important to students, too. They find that with Disston Tools their assignments are easier to perform, their work neater and more accurate, and their progress faster . . . all of which combine to simplify the instructor's task.

For better service and greater tool economy, specify ALL of the fine Disston Tools shown here.

Each of your students should have a copy of The Disston Saw, Tool and File Manual. Free copies may be obtained from hardware retailers, or students may write to us direct.

HELPFUL EDUCATIONAL AIDS for use in your classroom will be sent to you without charge. These include Wall Charts; Saw, Tool and File Manual; and Industrial Product Manuals for teacher reference on the use and maintenance of saws and tools. Write to us for a complete set today.

HENRY DISSTON & SONS, INC., 338 Tacony, Philadelphia 35, Pa., U.S.A.

Metalworking Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

AIR COMPRESSORS — for machine shop, foundry, or forge shop
ANVIL — 100 lb.
ARBOR PRESS — bench or pedestal type
BARROWS
- a) Coke
- b) Foundry
- c) Scrap

BELT LACER
BENCHES
- a) Coremaking
- b) For metal working, iron or steel legs. Tops, metal or hardwood lumber, 1¾ in. to 2½ in. thick
- c) Molding

BLACKBOARD — permanent or portable
BLOWERS — for furnaces, forges, etc.
BLOWTORCH — 1-qt. size
BOOKCASE — for reference books, catalogs, etc.
BORING BAR
BORING MILL — vertical or horizontal
BULLETIN BOARD
CABINETS — Wood or metal, for filing class records, instruction sheets, drawings, etc., and for tools and supplies
CASEHARDENING BOXES
CENTERING MACHINE
CHAIN HOISTS — differential, duplex or triplex
CHAIRS — teacher's, and tablet arm if needed for related-subjects room, or for demonstration section
CHUCK
- a) Drill, selected sizes
- b) Lathe, combination, 4 jaw, selected sizes
- c) Lathe, independent, 4 jaw, selected sizes
- d) Lathe, universal 3 jaw, selected sizes
- e) Milling machine, universal

CORE OVEN — for foundry
CRANES AND HOISTS — air, electric, or hand, of the jib, traveling, or portable type
CUPOLA — for foundry, coke, or electric, ¼- to 1-ton capacity
DESK — teacher's, with drawer compartments
DIE-FILING MACHINE
DIVIDING HEAD
DRILLS
- a) Bench, hand
- b) Breast
- c) Electric, portable
- d) Hand
- e) Post, hand or power
- f) Radial
- g) Sensitive
- h) Upright, power

FLASKS — 2 or 3 part, steel or snap type
FORGE — coal or gas, with hand- or electric-driven blower
FURNACES
- a) Annealing
- b) Bench
- c) Brass and soft metal
- d) Combination bench
- e) Casehardening
- f) Cyanide
- g) Gasoline
- h) Heat-treating
- j) Melting

GEAR-CUTTING MACHINE
GRINDER
- a) Bench, hand or power driven
- b) Combination grinder, buffer, and polisher
- c) Emery, bench or pedestal type
- d) Face, with magnetic chuck
- e) Portable tool post
- f) Precision, for external and internal grinding
- g) Universal tool cutter, drill and reamer grinder
- h) Wet tool

HACK SAW — motor or belt driven
HAND PICKS — for cleaning inside of cupola, 1¼ to 2½ lb.
HARDNESS TESTING MACHINE
LATHES — belt or individual drives
- a) Automatic
- b) Bench, 6-in. to 11-in. swing, 11 in. to 36 in. between centers
- c) Change gear, 9-in. to 14-in. swing, 18 in. to 36 in. between centers
- d) Quick-change gear, 9-in. to 16-in. swing, 18 in. to 36 in. between centers
- e) Semiquick-change gear, 9-in. to 18-in. swing, 18 in. to 42 in. between centers
- f) Turret
- g) Metal spinning

MILLING MACHINE
- a) Plain, cone or motor-driven type
- b) Universal, cone or motor-driven type

NIBBLING MACHINE
PIPE CUTTER
PLANER — belt or motor driven
POWER HAMMER — for forging operations
PUNCHES — metal, hand, or power
PYROMETER
PYROSCOPE
RELIEVING ATTACHMENT FOR LATHE
SAND SIFTER — for foundry, hand or power
SANDBLAST OUTFIT — with cabinet
SCALE
- a) Counter for machine shop
- b) Platform, for foundry, 1000-lb. capacity

SHAPER
SNAP-FLASK JACKETS — to fit snap flasks used
STRAIGHTENING PRESS
SURFACE PLATES
SWAGE BLOCK AND STAND — for forge shop
TAPER ATTACHMENT FOR LATHE
TRUCK — warehouse
TUMBLING BARREL — for foundry
VISES
- a) Blacksmith
- b) Drill press
- c) Machinist
- d) Pipe
- e) Planer
- f) Shaper

WELDING OUTFIT
- a) Acetylene
- b) Electric

Metalworking—Small Tools

ARBORS
- a) Drill chuck to suit requirements
- b) Reamers, various sizes
- c) Shell tool, various sizes
- d) Straight shank for shell reamers and shell drills, selected sizes
- e) Taper shank for shell reamers and shell drills, selected sizes

BEARING SCRAPER
BELLOWS — for foundry class
BEVEL PROTRACTOR
BROOMS AND FLOOR BRUSHES — for shop and foundry
BRUSHES
- a) Bench
- b) Core box
- c) Core painting
- d) Hard brushes for foundry
- e) Floor
- f) Soft brushes for foundry

BULB SPONGES — for molders
DRAW PINS — for molders
CALIPERS
- a) Hermaphrodite, 4 in. and 6 in.
- b) Inside, 4 in. and 6 in.
- c) Outside, 4 in. and 6 in.

CANS
- a) Oil, 1/3 pt., 1 pt., and 10 gal.
- b) Waste

CENTER TESTERS
CHISELS
- a) Cape, 3/8 in. and 5/8 in.
- b) Cold, 5/8 in. and 3/4 in.
- c) Diamond point, 3/8 in. and 1/2 in.
- d) Roundnose, 3/8 in. and 1/2 in.

CLAMPS
- a) 4 in., 6 in., 8 in., and 10 in.
- b) Flask, for foundry
- c) Strap, various sizes

CAKE FORKS — for foundry
COLLETS
- a) For milling machine, selected sizes
- b) For lathe, selected sizes

COMBINATION SQUARES—with hardened head and blade, and protractor head, 9 in. and 12 in.
COUNTERBORES — straight and tapered shanks, selected sizes
COUNTERSINKS — for metal
CRUCIBLE TONGS — to fit crucibles
CRUCIBLES — selected sizes
- a) Shanks, single end to fit ladles
- b) Shanks, hand, to fit ladle bowls

CUTTERS — angular milling, bevel gear, concave milling, convex milling, end milling, face milling, formed milling, grooving, involute gear teeth, key seat, side milling, and metal slitting

DIVIDERS — Spring, 4 in. and 6 in.
DRILLS
- a) Drifts, different sizes
- b) Sleeves, different sizes
- c) Stand for Nos. 1 to 60
- d) Stand for 1/16 in. to 1/2 in. by 64ths

DRILLS
- a) Center
- b) High speed, taper shank, various sizes
- c) Jobbers, straight shank, 1/16 in. to 1/2 in. by 64ths
- d) Ratchet
- e) Straight shank, Nos. 1 to 60
- f) Taper shank, 1/2 in. to 1 in. by 16ths

FILE CARDS
FILES
- a) Die sinkers, various shapes
- b) Flat bastard, 8 in., 10 in., 12 in., and 14 in.
- c) Half round, double cut, 6 in., 8 in., 10 in., and 12 in.
- d) Hand, smooth, 8 in., 10 in., and 12 in.
- e) Mill, smooth, 8 in., 10 in., and 12 in.
- f) Round bastard, 8 in., and 10 in.
- g) Square bastard, 8 in., and 10 in.
- h) Swiss, various shapes
- j) Three-square, double cut, 6 in.
- k) Warding, double cut, 6 in.

FIRST-AID CABINET AND SUPPLIES
FORGE TOOLS — drift pins, flatters, fullers, hand and handle punches, hardies, hot and cold cutters, set hammers, and swages for the forge shop
GATE STICKS — maple, for foundry
GAUGES
- a) Center
- b) Depth
- c) Drill and wire
- d) Screw pitch, select kinds
- e) Surface
- f) Thickness

GLOVES — asbestos, for foundry
GOGGLES
- a) For machine shop
- b) For foundry

HACK SAW
- a) Blades, hand, 18T, 10 in.

(Continued on page 30A)

THE LUFKIN RULE COMPANY

Saginaw, Michigan, U. S. A.

NEW YORK: 106-110 Lafayette Street

LUFKIN

PRECISION TOOLS:

- Micrometers
- Squares, Combination, etc.
- Calipers
- Dividers
- Steel Scales
- Indicators
- Protractors
- Bevels
- V Blocks
- Clamps
- Hold Downs
- Scribers
- Rules, Steel
- Punches, Center & Drive Pin

Gages:
- Center
- Depth
- Drill Grinding
- Feeler
- Planer
- Radius
- Screw Pitch
- Shaper
- Surface
- Telescoping
- Thickness

Tool Sets, Students

MEASURING TAPES:

- Chrome Clad Steel
- Nubian Finish Steel
- Stainless Steel
- Engineers Steel
- Surveyors Chain
- Metallic and Other Woven Types
- Pocket, Steel & Woven

STEEL TAPE-RULES:

Flexible—Rigid

RULES:

- "Red End" and Other Spring Joint
- Aluminum Folding
- Boxwood & Caliper
- Steel and Brass
- Manual Training
- Etc., Etc.

STURDILY BUILT--HYDRAULICALLY OPERATED
SIMPLE--SAFE--ECONOMICAL

The RACINE Utility Metal Cutting Saw combines the advantages of low cost and modern design. It is hydraulically operated, thus providing the trainee with a tool which is keeping pace with the latest ideas in machine tool principles and construction. The RACINE Utility is safe. The drive mechanism is completely enclosed. There are no trains of gears, levers or rachet devices to wear out, get out of adjustment or cause accidents.

While incorporating the best features of the larger RACINE Models, the Utility is simple to operate, easy to maintain. The capacity is 6" x 6" — ample for most needs. Two models are available. The Wet Cut shown above, has a built-in coolant system. The Dry Cut Model is the same unit without the coolant system.

Write for RACINE Catalog No. 70-C. Address RACINE TOOL AND MACHINE COMPANY, 1780 State Street, Racine, Wisconsin.

THE RACINE LINE PROVIDES
A WIDE CAPACITY RANGE

For schools having metal cutting requirements larger than 6" x 6", the RACINE Line provides hydraulically operated machines in a range of capacities up to 20" x 20".

You can do a faster, more accurate and more economical job with RACINE metal cutting machines. Their superiority is proven in all types of metal — from soft aluminum tubing to the hardest tool steels.

If your school has courses in hydraulics, it will pay you to investigate RACINE'S Line of hydraulic pumps and valves.

RACINE
RACINE
Standard for Quality and Precision

(Continued from page 28A)

b) Blades, power, 14T, 12 in.
c) Frames, adjustable
HAMMERS
a) Babbitt
b) Ball peen, 13 oz., 16 oz., or 20 oz.
c) Blacksmith's, various kinds
d) Riveting, 9 oz., and 12 oz.
e) Setting
INDICATOR
a) Center
b) Universal or universal dial test
c) Speed
KNURLING TOOL — with assorted knurls
LADLES
a) Bull
b) Hand bowls
c) Melting
LATHE DOGS — ½ in., ¾ in., 1 in., 1½ in., 2 in., 2½ in., and 3 in.
LEGGINGS — fireproofed duck, to protect students when pouring in foundry
LEVEL — 6-in. bench
LIFTING SCREWS — for molders
MALLETS — wood or soft
MANDRELS — selected sizes
MICROMETERS — inside, 1½ in. to 8 in.; outside, 0 to 1 in.; outside, 1 in. to 2 in.; outside, 2 in. to 3 in.
MOLDING BOARDS
MOLDING STICKS AND TROWELS — various kinds
NIPPERS — end cutting, 5 in.
OIL STORAGE TANK — with pump
OILSTONES — medium and fine
PAILS — galvanized, 12-qt. capacity for foundry
PARALLELS
a) Adjustable
b) Steel, assorted sizes
PLIERS
a) Combination, 6 in.
b) Side-cutting, 6 in.
PUNCHES
a) Center, ¼ in. and ⅜ in.
b) Hollow, ½ in., ¾ in., and 1 in.
c) Pin, ⅛ in., 5/32 in., 3/16 in., 7/32 in., and ¼ in.
d) Prick, ¼ in.
RAMMERS — for foundry
a) Hand
b) Floor
REAMERS — various sizes
a) Adjustable
b) Hand
c) Taper pin
d) With taper shank
RIDDLES — ¼-in. and ⅛-in. mesh, 18-in. diameter, for foundry
RIVET SETS — assorted sizes
SCALES
a) Steel, 6 in., graduated 1/64 in. to ⅛ in.
b) Steel, 12 in., graduated to 32nds
SCREW DRIVERS — 6 in. and 9 in. blade
SCRIBERS
SHOVELS
a) Coke
b) Sand
SNIPS — tin, 3 in. straight and 3 in. curved
SOCKETS — for taper shanks, drill and tools, selected sizes
SOLDERING COPPERS AND HANDLES — 1-lb. size
SPRAY CAN — for molders
SPRINKLING CANS — galvanized iron, 16-qt. capacity, for foundry
SPRUE PICKS — for molders
SQUARES
a) Machinist's, 6 in.
b) Blacksmith's
STEEL FIGURES, ⅛ in.
STEEL LETTERS — ⅛ in.
SWABS — for molders
TAPELINE — steel, 25 ft.
TAPS AND DIES
a) Machine screws
b) Pipe
c) N.F. ¼ in. to ¾ in.
d) N.C. ¼ in. to ¾ in.
TONGS
a) Blacksmith's, various kinds
b) Pick up, for foundry
c) Shake out, for foundry
TOOL HOLDERS
a) Boring tools
b) Cutting-off tools
c) Planer
d) R.H. and L.H. offset shank
e) Shaper
f) Slotter
g) Straight shank
h) Threading
TOOL-HOLDER BITS — square, ¾ in., 5/16 in., ⅜ in., 7/16 in., ½ in.
TRAMMEL POINTS
V BLOCKS AND CLAMPS
WHEEL DRESSER
WRENCHES
a) Adjustable, 8 in. and 10 in.
b) Pipe, 8 in. and 12 in.
c) Tap, adjustable, various sizes

Metalworking— Materials and Supplies

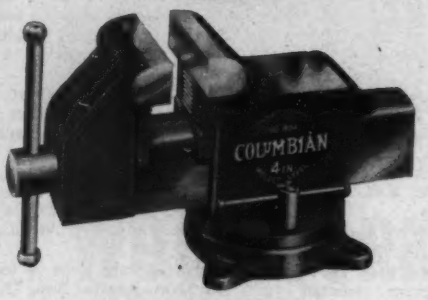
ABRASIVE CLOTH — aluminum oxide. Grits 320 to 24, obtainable in sheets or rolls from 1 to 28 in. wide
ABRASIVE WHEELS
ACETYLENE GAS — in drums for welding
ALUMINUM
a) Pigs for foundry
b) Sheets, tubing, rounds, shapes, wire, etc.
BABBITT METAL
BEARING BLUE
BELT DRESSING
BELT LACING MATERIAL
BELT LEATHER
BOLTS
a) Carriage, selected sizes
b) Lag, selected sizes
c) Machine, selected sizes
d) N.F., selected sizes
e) Stove, flat or roundheads, selected sizes
BRASS
a) Bars, 3/32 in., ⅛ in., 3/16 in., and ¼ in. thick; ⅜ in. to 1 in. wide, 8 ft. to 10 ft. long, selected sizes
b) Round rods, 3/16 in. to ½ in. by 16ths, selected sizes
c) Sheets, 28 to 32 American gauge, 12 in. wide by 72 in. to 84 in. long, selected sizes

(Continued on page 32A)

COLUMBIAN VISES

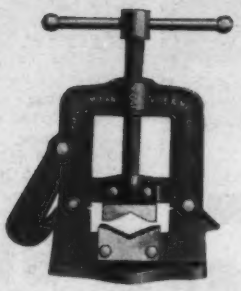
for many varied uses

There is a Columbian Vise for every need and purpose — all are made to the highest standard of workmanship and engineering.



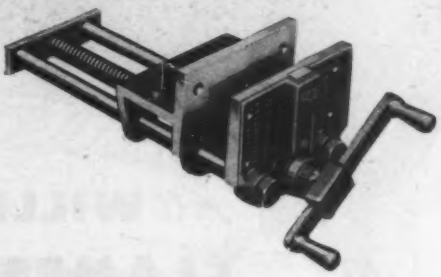
"804" STEEL WELDED WORKSHOP VISE

This all purpose vise is all steel fabricated by arc welding. Engineered for strength, accuracy, long life and greatest usefulness. Jaw width — 4 inches; jaw opening — 5 inches; weight — 20 lbs.; finished in bright "Columbian" red.



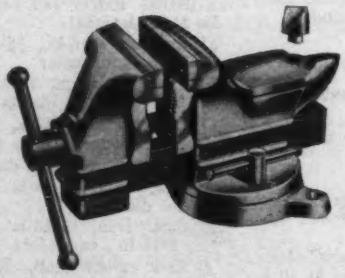
HINGED PIPE VISES

Columbian Malleable Iron HINGED PIPE Vises have self locking unbreakable hooks, tool steel pipe jaws, cold rolled steel screws and handles. Sizes for holding pipe from ⅛" up to 12". Every maintenance department should have one.



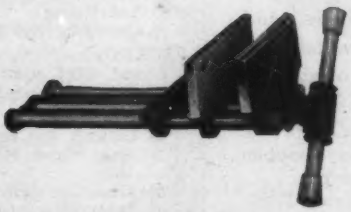
WOODWORKERS' VISES

Continuous Screw — Rapid Acting Columbian Woodworkers' Vises are finding increased uses in many plants particularly for the more ordinary types of pattern work. These durable low cost vises are sturdily built with jaw openings up to 12 inches.



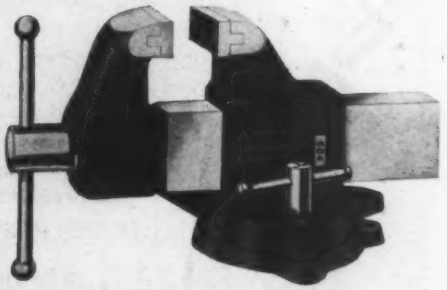
HOMESHOP VISES

Sturdily designed balanced strength and attractive appearance. A complete range of sizes, jaw widths 3", 3½" and 4"; jaw openings 3½", 4", 4½", for home workshop, garage and general use.



WOODWORKERS' VISES

Simple rapid acting mechanism. A slight turn of the handle engages threads of the nut and screw. A half turn tightens the vise to the work. Made in all popular sizes with jaw openings up to 12 inches.



MACHINISTS' VISES

Columbian Malleable Iron MACHINISTS' VISES are guaranteed unbreakable! In addition to their exceptional strength, Columbian engineering has built into these vises the finest mechanical perfection and special features appreciated by users. Made in all standard sizes — 3" to 8" jaw widths equipped with replaceable tool steel jaw faces.

THE COLUMBIAN VISE & MFG. CO.

9022 Bessemer Avenue • Cleveland 4, Ohio

THE WORLD'S LARGEST MAKERS OF VISES

All WILLIAMS CLAMPS ARE DROP-FORGED

● The more-than-usual holding power of Williams Clamps results from a combination of sound design and *drop-forged* strength. Despite their relative lightness in comparison with clamps made by other processes, you'll find Williams Clamps won't *spring or twist* under severe load. All Clamps are forged from selected steel and heat-treated — screws, of special steel, are hardened and tempered. Available in a wide range of sizes.

Write Dept. I-348
for this informative booklet
describing
Williams Machinists' Tools

J. H. WILLIAMS & CO.
400 VULCAN STREET
BUFFALO 7, NEW YORK

(Continued from page 30A)

d) Strips, 1/32 in. and 1/16 in. thick, ½ in. to 1½ in. wide, 50 ft. to a coil, selected sizes
e) Threaded rods, Nos. 6 to 10, in 24 in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24 in. lengths, selected sizes
f) Wire, soft, 8, 11, and 14 American gauge, selected sizes
g) Wire, spring, 8 to 22 American gauge, selected sizes

CASEHARDENING COMPOUNDS

CHAPLETS — single and double head

COAL
a) Charcoal for foundry or forge
b) Coke for foundry
c) Forge

COPPER
a) Pigs, for casting alloys
b) Sheets, 8 to 25 American gauge, 30 in. by 60 in., selected sizes
c) Tubing, outside diameters, 3/16 in., ¼ in., 5/16 in., ⅜ in., ½ in.; thickness of wall, 1/32 in.; lengths, 8 ft. to 12 ft., selected sizes
d) Wire, soft, 2 to 20 American gauge, in coils. Also in ¼, ½, and 1 lb. spools, sizes 16 to 36, English gauge, selected sizes

CORE
a) Compounds
b) Flour
c) Paste
d) Oil
e) Wax-vent wire

CUTTING COMPOUNDS

FIREBRICKS AND CLAY — for foundry

FIRE HANDLES — assorted sizes

GRAPHITE — for foundry

IRON — Pig, for foundry

LACQUER — transparent and colored, for finishing

NUTS — S.A.A., acorn cap, castellated, square, hexagon, joint, and wing, selected sizes and kinds

OIL
a) Boiled linseed
b) Lubricating
c) Quenching and hardening

PACKING
Round, sheet, square, or tubular

PAINT — back asphaltum

PINS
a) Cotter, 3/32-in. to ¼-in. diam. from ½ in. to 2 in. long
b) Flask, for flask repairs
c) Taper, Nos. 0 to 6, ¾ in. to 2 in. long

PUMICE POWDER

RIVETS
a) Copper, with burrs, Nos. 7 to 14, lengths, ⅜ in. to ¾ in., selected sizes
b) Iron, No. 14 gauge to 3/16 in., flathead or button head, ¼ in. to 1 in. long, selected sizes
c) Tinners', flathead, 8 oz. to 16 lb., either tinned or black, selected sizes

SAND
a) Molding, in 350-lb. barrels or 800-lb. casks
b) Parting, in 350-lb. barrels or 800-lb. casks

SCREWS
a) Flathead or roundhead iron or brass, selected sizes and kinds
b) Cap and machine, iron or brass, selected sizes and kinds
c) Set, head and headless

SOLDER — acid or rosin core; bar, or solid wire

SOLDERING PASTE OR SALTS

STEEL
a) Bessemer, rod, 1/64 in. to ¾ in. by 64ths, in 4-ft. lengths, selected sizes
b) Bars, cold rolled, ⅛ in. to ¾ in. thick, ½ in. to 2 in. wide, 12-ft. lengths, selected sizes
c) Drill rod, letter sizes, A to Z, number sizes, 1 to 80, in 3-ft. lengths, selected sizes
d) Rods, hexagon and square, cold rolled, ¼ in. to ¾ in., in 12-ft. lengths, selected sizes
e) Round, cold rolled, diameters ⅛ in. to 1 in., lengths 12 ft., selected sizes
f) Sheet, black, Nos. 18, 20, 22, 24, 26, 28, U. S. gauge; size of sheets, 24 in., 28 in., and 30 by 96 in.
g) Sheet, galvanized, Nos. 18, 20, 22, 24, 26, 27, and 28 U. S. gauge; size of sheets, 24 in., 28 in., and 30 by 96 in., selected sizes
h) Threaded rods, Nos. 6 to 10, in 12-in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24-in. lengths, selected sizes

TIN
a) Pigs, for casting alloys
b) 1C, 1X, 20 by 48 in.
c) 1XX, 20 by 48 in.

WASHERS AND BURRS
a) Copper, burrs, Nos. 3 to 14, in 1-lb. boxes
b) Iron burrs, Nos. 3 to 14, in 1-lb. boxes
c) Brass washers, 3/16 in. to ⅜ in. by 16ths
d) Iron washers, 3/16 in. to ⅜ in. by 16ths

WELDING FLUXES

WELDING RODS (all rods come in 24-in. lengths)
a) Brazing, 1/16-in., ⅛-in., and 3/16-in. diameter
b) Cast aluminum, 3/16-in., ¼-in., and ⅜-in. diameter
c) Cast brass, 3/16-in., and ⅜-in. diameter
d) Cast bronze, ¼-in. diameter
e) Cast copper, 3/16-in. and ¼-in. diameter
f) Cast iron, 3/16-in., ¼-in., 5/16-in., and ⅜-in. diameter
g) Low carbon steel, ⅛-in., ¼-in., and ⅜-in. diameter

WHITE LEAD — for machine shop

WIRE
a) Annealed, 16 to 34 W and M gauge, selected sizes
b) Coppered market, 5 to 18 W and M gauge, selected sizes
c) Coppered spring, 2 to 18 W and M gauge, selected sizes
d) Galvanized, 5 to 18 W and M gauge, selected sizes
e) Piano, Nos. 2/0 to 36, selected sizes
f) Tinned, 16 to 24 W and M gauge, selected sizes
g) Wool, Nos. 0 to 3 in 1-lb. packages, selected sizes

ZINC
a) Pigs, for casting alloys
b) Sheet, Nos. 4 to 14, sheets 36 in. by 84 in.

BRODHEAD-GARRETT SCORES AGAIN!

WOODWORKING BENCH

Surface Size
54" x 64"

L-4 LOCKER TYPE...

Here is the specially constructed locker type woodworking bench available now for immediate delivery. This popular bench has a large flat all-maple durable top with a vise at each corner, thus providing four separate work stations for individual projects.

We have a supply of these outstanding benches in answer to the many requests that have come to us during the past year. When writing—specify L-4 locker type.

FEATURES...

Sturdy, reinforced maple top . . . vise ends of bench reinforced with heavy 5" batten providing solid, indestructible foundation . . . 12 lockers sturdily constructed of 20 gauge metal and finished in attractive olive green enamel . . . this type conserves floor space and still provides ample working area . . . height 32-1/4", bench surface 54"x 64". . . 4 5CD Columbian vises. Only.....$195.00

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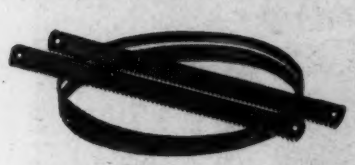
CLEVELAND 5, OHIO

STARRETT TOOLS
AND TRAINING AID
To Help You Teach Fine Workmanship



STARRETT HACKSAWS

There is a STARRETT Hacksaw for every job — Standard Flexible Back, All Hard and "Semi-Flex," "S-M" Molybdenum, "Safe-Flex" Class A—High Speed Steel and 18-4-1 High Speed Steel—for all kinds of hand sawing; "S-M" Molybdenum for light and heavy power sawing and High Speed Steel for power sawing of high alloy metals, stainless steel, phosphor bronze, tool steel, monel, etc.

STARRETT PRECISION MEASURING TOOLS

The fine workmanship and lasting accuracy that have made Starrett Tools the choice of skilled machinists have also made them standard school shop equipment. STARRETT Student Set No. 902 containing measuring tools essential for school shop classes is again available through your tool dealer.

STARRETT BAND SAWS FOR CUTTING METAL, WOOD, PLASTICS, ETC.

STARRETT hard edge, flexible back Metal Cutting Band Saws are available in coils of any length or cut to length and welded. STARRETT "Skip-Tooth" Band Saws for fast cutting of magnesium, aluminum and other non-ferrous metals, also for wood, plastics and special compositions.

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A handy source of information student machinists must have about tools, machines and modern methods. Prepared in cooperation with leading vocational training experts, it is written in simple shop language, contains more than 200 illustrations and 30 useful reference tables. Available through your local Starrett Tool distributor at one dollar a copy. Descriptive Folder furnished on request.

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A valuable and practical instruction aid on the use of precision tools. The set consists of fourteen blue-printed 8" x 10½" punched sheets, each illustrating an important tool and its uses. Furnished to instructors and students at cost — 10 cents per set.

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World's Greatest Toolmakers

STARRETT TOOLS

(Continued from page 26A)

developed the first General Electric ramjet.

..... 1. Jet propulsion is rotary power.
..... 2. A jet-propelled rocket rises slowly, its speed gradually increasing until it attains a tremendous rate in the ionosphere.
..... 3. In 1908 a six-cylinder jet-propelled motor was designed by Loring and Marconnet.
..... 4. Germany put the first jet fighters into the air in the summer of 1946.
..... 5. A jet-propelled plane of the turbo-generator type operates on the principle of thrust.
..... 6. The XS11 burns ethyl alcohol, oxidized by liquid nitrogen.
..... 7. The compression of the turbo-supercharger is so high that the heat of compression must be removed by an intercooler before it enters the cylinders.
..... 8. The mixture of ethyl alcohol and liquid oxygen in a V-2 rocket burns at high pressure in a combustion chamber and the gases are exhausted through a supersonic nozzle.
..... 9. The tail surfaces on jet-propelled planes must be made as thick as possible.
..... 10. The greatest suitability of the ramjet is for supersonic planes or missiles.
..... 11. In 1930 Franklin H. Pierce built one of the first liquid-nitrogen-gasoline rockets.
..... 12. The XS11 without fuel weighs only two hundred ten pounds and its over-all length is 66 inches.
..... 13. A jet-propelled plane can fly from ten to twenty thousand feet higher than an ordinary propeller-driven plane.
..... 14. Sir Isaac Newton's third law of motion states that to every action there is always an equal and contrary action.
..... 15. In addition to its terrific speed a big advantage of the jet-propelled plane is its phenomenal rate of climb.

Scoring Part II: Raw score or total number of questions answered correctly.

Part III

Specific directions to the student: Answer each of the following questions with a single word. Letter neatly the answer in the blank space left in front of the question.

Example:

..Goddard.. 1. What is the last name of the man who died in 1945 and had developed the basic theory of the liquid-fuel rocket in 1919?
..... 2. What is the word used to describe speed which is faster than sound?
..... 3. How many tons do the German V-2 rockets approximately weigh?
..... 4. What is the least number of moving gears any jet-propelled plane motor has?
..... 5. What is the first name of the aircraft corporation of which R. M. Stanley is chief engineer and who designed the XS11?
..... 6. What country had ten or more large supersonic high-speed wind tunnels during World War II?
..... 7. Where does the energy of coal come from?
..... 8. In feet, what is the approximate diameter of a V-2 rocket?
..... 9. What is the last name of the Frenchman who in 1930 was an expert of the rocket system of propulsion and in his book outlined plans for a

(Continued on next page)

(Continued from previous page)

flight to the moon?

..... 10. During World War II what country was almost concurrent with Germany in turbojet development?

..... 11. Broadly speaking, there are two basic types of chemical reaction, as far as energy is concerned. One is known as endothermic. What is the name of the other type?

..... 12. What is the last name of the well-known Belgian pilot who made the remarkable stratosphere ascents in the years 1931 and 1932?

..... 13. What element is it that makes fuel give up its energy in steam or gasoline engines?

..... 14. What is the first monopropellant worked out by Dr. Fritz Zwicky during World War II called, which is a liquid containing both fuel and oxydizer in stable form at normal temperatures?

..... 15. What is another term for the chemical compound potassium nitrate?

Scoring Part III: Raw score or total number of questions answered correctly.

Part IV

Specific directions to student: Each of the following sentences defines one of the words shown at the end of Part IV of this test. Make the proper connections by lettering neatly the number preceding the sentence in front of the word at the end of this test with which it should be associated.

Example:

1. The total output of a jet-propelled motor.
2. The recoil produced by a jet motor which provides the propulsive force.
3. The outer casing for a large rocket projectile.
4. The bell-shaped inner curve of some types of rocket motor nozzles.
5. The combustible component of a rocket propellant.

..... airfoil	...1... impulse
..... flap	...2... reaction
...4... flare	..... thrust
...5... fuel	..... torque
...3... hull	..... turbojet

1. A reaction balance or device for indicating and recording the thrust of a rocket propelled motor during a test.
2. A device with high initial speed for launching a rocket or airplane.
3. The moment of a force to produce rotation.
4. A device for providing a thrust for driving an airplane at the expense of power generated by a motor.
5. Fixed rudders on a rocket used to help give the rocket direction.
6. The stream of gas ejected by a reaction motor.
7. A colorless and tasteless gas which condenses into a deep blue liquid. The blue liquid is fairly stable at temperatures below its melting point of —119 deg. C.
8. A rocket flight.
9. A mechanism consisting essentially of a tube or tubes, in which an explosive compound, carrying its own oxygen, is deposited and burned. The reaction on the mechanism propels it in the opposite direction.
10. The push produced by a jet or rocket propelled motor.
11. A steering device placed in the jet of a rocket to direct flight.
12. A small tubular rocket launcher with hand grips, shoulder stock and sights, used by infantry to fire antitank rockets.
13. A mechanism for controlling or observing a flying rocket from the ground.
14. The material used in a rocket propelled motor to produce the driving jet.
15. The curve which a body, as a missile, describes in moving through space or the atmosphere under the influence of the force of gravity.

..... airfoil	..... fin
..... aeroresonator	..... flap
..... airscrew	..... flare
..... axis	..... hydrogen
..... bazooka	..... hull
..... catapult	..... Jato
..... coolant	..... jet
..... dynamometer	..... Katusha

(Continued on next page)

TU-S56 LATHE

Teachers know . . .

— no other bearing can hold accuracy under abuse as well as taper roller bearings.

The Sheldon TU-S56 lathe is ideal for school shop for it combines:

- **SAFETY**
  Headstock is entirely enclosed. All speed changes are made by outside levers. Students never touch a belt or drive.
- **PERMANENT ACCURACY**
  "Zero Precision" tapered roller Spindle Bearing the most accurate bearings obtainable of the type that hold accuracy without servicing.
- **BIG LATHE DESIGNS AND FEATURES**
  Thousand pound precision lathe of advanced design with standard big lathe controls, construction and features.

Produced in quantity in a specially built and tooled plant to sell at a moderate price.

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Automotive Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

AIR COMPRESSOR
- *a*) 3 to 4 cu. ft., with tank, piping, and motor
- *b*) Small portable, 1 cu. ft., with motor

ALIGNING JIG — for connecting rods

ANVIL
- *a*) No. 100 or No. 125
- *b*) Rim

ARMATURE GROWLER AND TESTER

AXLE STANDS

BATTERY EQUIPMENT
- *a*) Cell tester, panel type with discharge rack
- *b*) Charger (15-battery size) with rack
- *c*) Charger (6-battery size)
- *d*) Gas stove (small)
- *e*) Lead-burning torches, with gauges and piping
- *f*) Plate racks

BENCH
- *a*) Electric test, elaborate
- *b*) Electric test, simple
- *c*) Work, with vises
- *d*) Work, portable with vise

BLACKBOARD

BLOWTORCHES — 1-qt. size

BOOKCASE

BRAKE
- *a*) Adjusting stand
- *b*) Band-lining machine

BULLETIN BOARD

CABINETS
- *a*) Wood or metal, for bolts and supplies
- *b*) Wood or metal, for filing job sheets and correspondence

CHAIN HOIST — with overhead trolley and track

CHAIRS
- *a*) Teacher's
- *b*) For tables, or with tablet arms

CRANE — portable

CRANKSHAFT TRUING TOOL

CREEPERS

DESK — teacher's

DRILL
- *a*) Breast
- *b*) Hand
- *c*) Electric portable, ⅜ in.
- *d*) Electric portable, ¼ in.
- *e*) Press, 21 in., with motor and chuck

DYNAMOMETER — electric

FORGE — with blower and tools

FURNACES — gas

GREASE DISPENSERS

GRINDER
- *a*) Cylinder with motor
- *b*) 8 in., with motor
- *c*) 12 in., with motor

HONES — cylinder

JACKS
- *a*) Lever, 1½-ton
- *b*) Floor, roller

LATHE
- *a*) 11 in. by 4 ft., with motor, chucks, and attachments
- *b*) 16 in. by 6 ft., with motor, chucks, and attachments

PRESS
- *a*) Arbor
- *b*) 30 ton

SPRAY PAINTING OUTFIT

VALVE REFACING MACHINE

VULCANIZER
- *a*) Electric steam for tube work
- *b*) Small, hand

WELDING OUTFIT — with tanks, gauges, and cutting torch

WHEEL ALIGNMENT
- *a*) Gauge
- *b*) Test table

Automotive Shop—Small Tools

ABRASIVE — rubstone for cleaning castings in foundry

ALCOHOL TESTER

BATTERY
- *a*) Cell tester, prod type
- *b*) Cell tester, cadmium
- *c*) Clips, large
- *d*) Element pullers
- *e*) Fillers
- *f*) Funnels, glass
- *g*) Hydrometer, acid
- *h*) Knives
- *i*) Post builders
- *k*) Post drills
- *l*) Post markers
- *m*) Separator trimmer

BITS
- *a*) Expansive
- *b*) Ratchet brace
- *c*) Wood, 3/16 in. to 1 in.

BOLT CUTTER — 24 in. and 36 in.

CALIPERS — 6 in. inside and outside

CANS
- *a*) Oil, 1/3 pt.
- *b*) 1 gal., gas, safety
- *c*) 5 gal., gas, safety
- *d*) 5 gal., kerosine
- *e*) Waste

CHECKS — tool, 1000, blank

CHISELS
- *a*) Cape, 3/8 in. and 5/8 in.
- *b*) Cold, 1/4 in., 5/8 in., 3/4 in., 1 in.
- *c*) Diamond point

COMBINATION SQUARES — 12 in.

COTTER-PIN EXTRACTOR

DIVIDERS — 6 in. and 10 in.

DRILL SETS
- *a*) 1/32 in. to ½ in., by 64ths
- *b*) ½ in. to 1¼ in., by 32nds

FILE CARDS

FILE HANDLES — assorted

FILES
- *a*) Flat bastard, 6 in., 8 in., 10 in., and 12 in.
- *b*) Half round, 6 in., 8 in., 10 in., and 12 in.
- *c*) Mill, 6 in., 8 in., 10 in., and 12 in.
- *d*) Round, 6 in., 8 in., 10 in., and 12 in.
- *e*) Square, 8 in., 10 in., and 12 in.

FIRE EXTINGUISHERS — Pyrene and Acid

FIRST-AID CABINET AND SUPPLIES

FLOOR BRUSHES — 18 in.

FUNNELS — tin, assorted sizes

GAUGES
- *a*) Air pressure
- *b*) Center
- *c*) Depth
- *d*) Thread
- *e*) Thickness

GLASS CUTTERS

GOGGLES

GREASE GUNS — plain and pressure type

HAMMERS
- *a*) Ball peen, 4 oz.
- *b*) Ball peen, 1¼ lb.
- *c*) Ball peen, 2 lb.
- *d*) Lead
- *e*) Riveting
- *f*) Sledge, No. 12

LADLE
- *a*) 3-in. bowl
- *b*) 6-in. bowl

LAMPS — extension, with reels

LEAD POT — gas

MAGNET CHARGER

METERS — volt and ammeter test

MICROMETERS
- *a*) Outside, 0 to 1 in.
- *b*) Outside, 2 in. to 3 in.
- *c*) Outside, 3 in. to 4 in.
- *d*) Inside, 1½ in. to 6 in.

MOLDS
- *a*) Battery nut
- *b*) Battery post
- *c*) Battery strap
- *d*) Burning stick
- *e*) Lead hammer

OILSTONE

PIPE TAPS — ⅛ in., ¼ in., ⅜ in., and ½ in.

PLIERS
- *a*) Combination, 6 in.
- *b*) Flat nose
- *c*) Roundnose

PULLERS
- *a*) Bearing
- *b*) Gear
- *c*) Wheel, hub type

PUNCHES
- *a*) Center
- *b*) Taper pin
- *c*) Blacksmith

PUTTY KNIVES

(Continued on page 38A)

(Continued from previous page)

..... orifice	..... thrust
..... ozone	..... torque
..... propellant	..... tracker
..... radiosonde	..... trajectory
..... rocket	..... turbofan
..... shot	..... turboprop

Scoring Part IV: Raw score or total number of questions answered correctly.

Part V

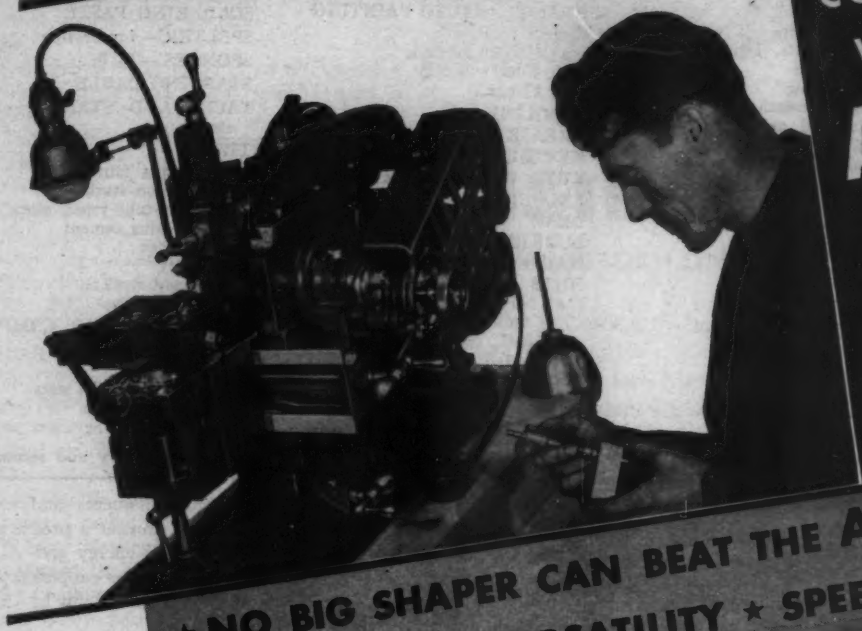
Specific directions to the student: The following questions can be answered by a single word. Complete each statement by lettering neatly the missing word in each blank space. Your score for this part will be based on the number of blank spaces correctly filled. No penalty will be exacted for blank spaces incorrectly filled.

Example:

1. The compressor and turbine of a jet motor are mounted on the same ...shaft....
2. The robot bomb uses a crude form of jet ...propulsion....
3. Elementary data for high-speed flight cannot be accumulated without an adequate supersonic wind ...tunnel....
1. That branch of hydrodynamics which deals with the effects of forces acting between the various parts of a gaseous medium, or between such a medium and solid bodies with which it is in contact is called .....
2. The gas which is needed to burn the fuel in a rocket is called .....
3. The basic scientific explanation of the principle of jet propulsion are Sir Isaac Newton's three laws of .....
4. The Bell XS–1 designed to fly eventually at 1700 miles per hour is expected to reach a top speed and a record of ..... thousand feet.
5. The body of a jet-propelled plane must be small, barely large enough to enclose the pilot and .....
6. Pratt and Whitney and Wright Aeronautical are working intensively on ..... jets.
7. In 1944 Dr. Fritz Zwicky tried to interest the United States government in a new powerful engine missile that was somewhere in the area of the aerduct or .....
8. Within 63 seconds from the time the firing button is pressed, the V–2 rocket burns 10,000 pounds of liquid oxygen and 8304 pounds of ethyl .....
9. A rocket motor creates its own fumes and gases for .....
10. Seconds after America's rocket-propelled plane dropped away from the B–29 bomber, Goodlin turned on the power and the craft darted away with a momentum which the former navy pilot compared to the thrust aboard a carrier from a .....
11. It is expected that in less than a decade turbojet air transports will be cruising easily just under the speed of .....

(Continued on page 38A)

WHY USE AN ELEPHANT TO PULL A MILK WAGON . . . and



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You will save time, labor and electricity—and get finest precision work—every day you use this AMMCO 7" Shaper. It will do a wide variety of work—in fact, it has been called "the precision machine with a thousand uses." It is compact and saves floor space, tough enough for the heaviest production schedule, perfect for tool and die making and ideal for home work shops. Order the bench or portable cabinet models. Write for complete data and low prices and a copy of catalog IA-348.

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AMMCO TOOLS, INC. · COMMONWEALTH AVE. · NORTH CHICAGO, ILL.

(Continued from page 36A)

REAMER — spindle bolt
REAMER SETS
- *a*) Piston pin, ⅛ in. to 1¼ in.
- *b*) Taper pin
- *c*) Valve seat

SAWS
- *a*) Hack, frames, 10 in., adjustable
- *b*) Hack-saw blades, 18, 20, and 24 teeth
- *c*) Hand

SCALES
- *a*) Steel, 6 in., graduated 1/64 and 1/100 in.
- *b*) Steel, 12 in., graduated 1/32 in.

SCRAPERS
- *a*) Bearing
- *b*) Carbon

SCREW DRIVERS
- *a*) 6 in. and 12 in.
- *b*) Small combination

SCREW EXTRACTORS
SCRIBERS
SNIPS — tin, 3 in. straight and 3 in. curved
SOLDERING COPPERS — 1, 2, and 3 lb. with handles
SPRING SPREADERS
STAMPS
- *a*) Figures, 3/16 in.
- *b*) Letters, 3/16 in.

TAP-AND-DIE SETS
- *a*) Machine screw
- *b*) N.F. ¼ in. to 1 in.
- *c*) N.C. ¼ in. to 1 in.

TIRE TOOLS
TOOL KIT — metal box or canvas roll, empty
TWIST DRILLS — (extra sets) selected sizes
VALVE
- *a*) Grinders (hand)
- *b*) Spring lifters

WRENCHES
- *a*) 8 in., 10 in., 12 in., and 18 in.
- *b*) Ignition sets
- *c*) Pipe, 10 in., 14 in., 16 in., and 18 in.
- *d*) Rim socket
- *e*) Socket sets, large assortment with case
- *f*) Spark plug
- *g*) Speed wrenches
- *h*) Standard end sets, ¼ in. to ⅞ in., N.C. and N.F.
- *j*) Valve-tappet wrenches

Automotive Shop—
Materials and Supplies

ABRASIVE CLOTH AND PAPER — aluminum oxide and silicon carbide
ACETYLENE GAS — in drums, for welding
ACID
ALCOHOL
BABBITT
BEARING BLUE
BEARING COMPOUND
BOLTS
- *a*) Machine, selected sizes
- *b*) N.F. selected sizes
- *c*) Stove, flat or round heads, selected sizes

BRAKE JUICE — ½-pt. cans
BRUSHES
- *a*) Paint
- *b*) Spark plug
- *c*) Spoke
- *d*) Steel
- *e*) Varnish

CHAMOIS
COIL-SPRING ASSORTMENT
COPPER TUBING
COTTER PINS — assorted sizes
CROCUS CLOTH
DISTILLED WATER
DRAIN COCKS
ELECTROLYTE
ENAMEL — AUTO PAINTING
GASKETS
- *a*) Copper asbestos
- *b*) Cork and felt
- *c*) Flange

GASOLINE
GREASE — cup, cans
KEROSINE
KEYS, WHITNEY — assorted
LACQUER — colors
LEAD
LUBRICANT — transmission
NAILS AND BRADS
NUTS
- *a*) N.F., castellated, square, hexagon, selected sizes and kinds
- *b*) N.C., square and hexagon, selected sizes
- *c*) Machine screw, selected sizes
- *d*) Wing, selected sizes

OIL
- *a*) Cylinder, light, medium, and heavy
- *b*) 600W
- *c*) Penetrating

OXYGEN — in drums for lead burning
PIG LEAD
PISTON-RING COMPRESSORS
RADIATOR HOSE
RIVETS — brake lining, 5/16 in., ½ in., and ¾ in. long.
SCREWS
- *a*) Flathead or roundhead, iron or brass, selected sizes and kinds
- *b*) Cap and machine, iron, or brass, selected sizes and kinds

SEALING COMPOUND
SHELLAC — ½-pt. cans
SHIM STOCK
SOAPSTONE
SOLDER — bar, wire, or self-fluxing wire
SOLDERING PASTE
SPELTER — for brazing
SPONGES — ½ lb.
STARTING CABLE
TACKS AND STAPLES — upholstery
TIRE
- *a*) Carcass fabric
- *b*) Cushion stock
- *c*) Inner-tube repair stock
- *d*) Patching cement
- *e*) Patches
- *f*) Putty
- *g*) Tread stock
- *h*) Vulcanizing

VALVE-GRINDING COMPOUND — coarse and fine
WASHERS
- *a*) Lock, assorted sizes
- *b*) Wrought iron

WASTE
WIRE — primary and secondary

(Continued from page 36A)

12. The thrust of a reaction motor can be calculated by applying the formula T = MV, where T is the thrust, M is the mass ejected per second, and V is the velocity in feet per second of the .....

13. V–2 rockets speed as fast as 3400 miles per hour on part of their trajectory into the .....

14. It is planned to christen the Smith-Ross rocket the .....

15. A P–80 jet powered shooting star going five hundred miles per hour recently photographed a four hundred mile stretch between Dayton and Washington which was so accurate it revealed the earth's surface .....

Scoring Part V: Raw score or total number of blank spaces correctly filled. .....

Part VI

Specific directions to the student: The following questions can be answered by a single word. Complete each statement by lettering neatly the missing word in each blank space. The missing words may be found in the list of words at the end of Part VI of this test. Do not use the same word more than once. Your score for this part will be based on the number of blank spaces correctly filled. No penalty will be exacted for blank spaces incorrectly filled.

Example:

1. To fly higher and faster man must move up in the progressive order of jet-propulsion motors to the pulse-jet, ramjet, and finally the pure liquid-fuel ....rocket.....

2. From one hundred ninety miles up the radius of vision is one thousand ....three.... hundred miles.

3. Jet planes use the oxygen of the air to obtain propulsive ....power.....

4. A jet plane flies through the air without a ....propeller.....

carburetor	propeller	three
movement	rocket	two
power	sound	

1. There are at least three main types of turbojets to choose from, with more variations than was ever possible in a .....

2. In the simple gun power-fuel reaction motor, it is the carbon dioxide and sulphur dioxide which form the principal materials of the .....

3. The German V–2 rockets have ..... control.

4. The use of rockets in warfare reached its prime in the early part of the ..... century.

5. An apparatus for moving a stream of air at high velocity over aeronautical models in the study of aerodynamics is called a wind .....

6. The British M–52's 17,000 horsepower, three stage power plant almost filled the .....

7. V–2 rockets have been reported glowing red-hot due to air .....

8. Hydrogen peroxide may detonate all by itself at unexpected moments and must be carefully handled to prevent a premature and disastrous release of its energy and .....

9. The tiny XS–1 rocket-propelled plane of the American air force was built by ..... Aircraft.

10. British engineers are making an all-out attempt to build aircraft that will fly faster than the speed of .....

11. The turbo-supercharger is used to compress the air before it enters the .....

12. The calculations of rocket experts indicate that a rocket for successful interplanetary travel must employ the step principle or idea of .....

13. General Electric engineers developed the jet propulsion motor from an original design by Group Captain of the R.A.F., Frank .....

14. After the Megaroc's take-off from a vertical position, the rocket motors will exhaust their fuel and cut out after ..... minutes.

15. It is almost the unanimous opinion of rocket experts of today that the rockets of the future will be the rockets with ..... fuel.

air	eighteenth	gyro
bazooka	fire	jet
Bell	four	Katusha
Boxer	friction	light
carburetor	fuselage	liquid
compressor	gas	lox

(Continued on next page)

(Continued from previous page)

motor	oxygen	tunnel
movement	reciprocators	twentieth
McDonnell	rockets	two
nineteenth	servometer	Whitney
nitrogen	seventeenth	whittle
nose	sound	wing
one	three	

Scoring Part VI: Raw score or total number of blank spaces correctly filled.

Part VII

Specific directions to the student: Each of the following statements can be correctly completed by the use of one of the words contained within the parenthesis. Underline the correct word in each sentence.

Example:

A jet-propelled motor operates on Sir Isaac Newton's (first, second, *third*, fourth) law of motion.

1. The limits of the conventional aircraft engine or reciprocator are generally agreed to be about 4000 horsepower and about (400, 500, 600, 700) m.p.h.

2. The rocket used in fireworks is made of a mixture of sulphur, saltpeter, and (charcoal, dipropellant, nitrogen, nitroglycerine).

3. The XS–1 was carried aloft at Muroc, Calif., to an altitude of (15, 25, 35, 45) thousand feet.

4. In 1893 a dirigible propelled by an automatic powder rocket was patented by an American engineer, Sumter B. (Battey, Ganswindt, Peterson, Zucker).

5. The Bell SX–1 is powered by a four-unit rocket motor with a (six, seven, eight, nine) thousand pound thrust.

6. Sir Isaac Newton's third law of motion is a complete statement of the principle upon which the (action, compression, reaction, reciprocating) motor operates.

7. The XS–11 was cut loose at (fifteen, twenty, twenty-five, thirty) thousand feet.

8. War rockets have a steel tube with a (brass, copper, monel, steel) head.

9. The propeller of an airplane decreases rapidly in efficiency at speeds above (two, three, four, five) hundred m.p.h.

10. Although the General Electric gas turbines owe much to their own design they were greatly influenced by the British (Bell, Ross, Smith, Whittle) motor.

11. The simplest form of reaction motor and the best known is the one that drives an ordinary (bazooka, compressor, reciprocator, skyrocket).

12. A special P–47 reached a speed limit of five hundred miles per hour and the propeller efficiency stayed close to (sixty, seventy, eighty, ninety) per cent.

13. Instead of horsepower the power of a jet-propelled plane is measured in terms of (impulse, megaroc, propulsion, thrust).

14. The computing machine which determined the altitude, range, trajectory, and velocity of the V–2 rocket for the General Electric scientists is known as a differential (analyzer, bazooka, delayer, gyro control).

(Continued on page 41A)

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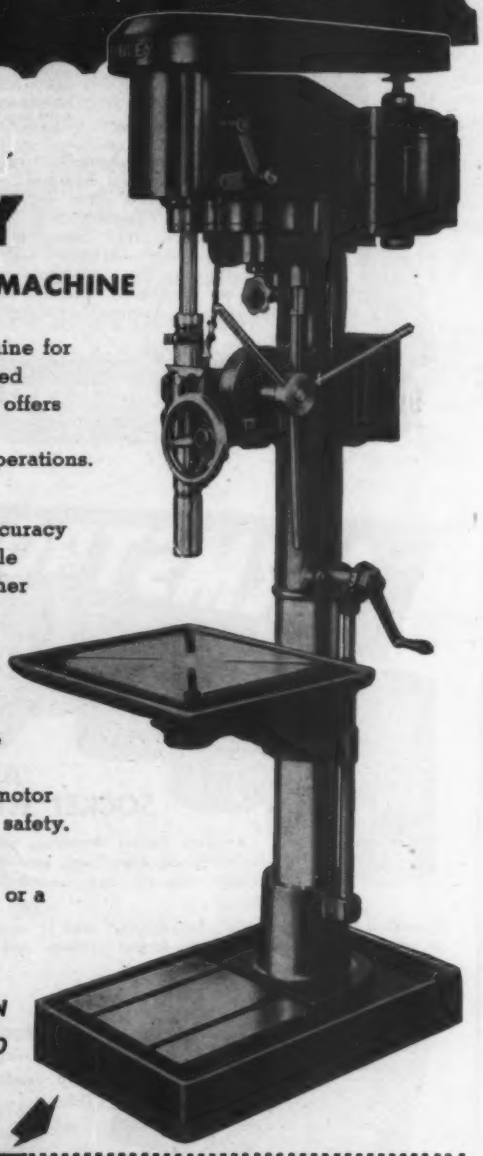

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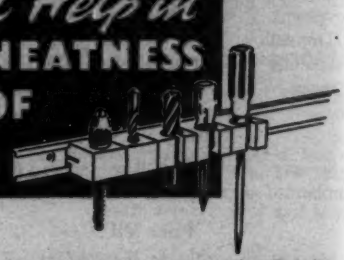

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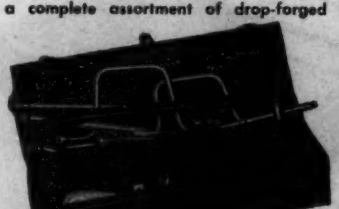

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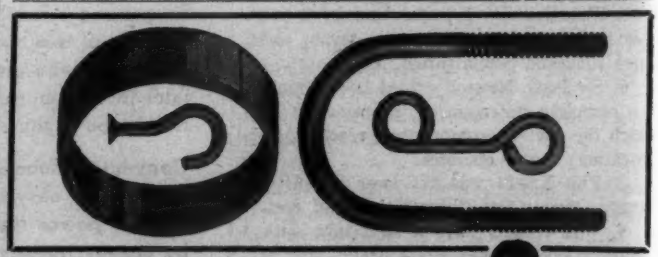

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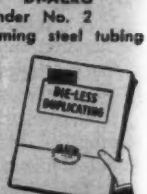

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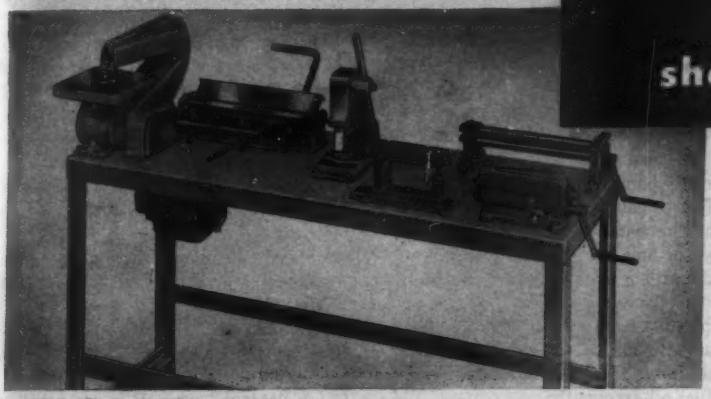

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(Continued from page 39A)

15. The American rocket weapon technically known as "Launcher, Rocket, AT, M–1," is more familiarly known as the (bazooka, catapult, Jaypee, Katusha).

Scoring Part VII: Raw score or total number of words or numbers correctly underlined .....

KEY — PART I

1. F	7. F	13. F	19. T	25. T
2. T	8. F	14. T	20. T	26. F
3. T	9. T	15. F	21. F	27. T
4. F	10. F	16. F	22. T	28. F
5. T	11. T	17. T	23. F	29. F
6. T	12. T	18. F	24. F	30. T

KEY — PART II

1. (rotary) should be (rocket)
2. T
3. T
4. (six) should be (three)
5. T
6. (nitrogen) should be (oxygen)
7. (cylinders) should be (carburetor)
8. T
9. (thick) should be (thin)
10. T
11. (nitrogen) should be (oxygen)
12. (sixty) should be (fifty)
13. T
14. (action) should be (reaction)
15. T

KEY — PART III

1. Newton	6. Germany	11. exothermic
2. supersonic	7. sun	12. Picard
3. fifteen	8. five	13. oxygen
4. one	9. Pelterie	14. nitromethane
5. Bell	10. England	15. saltpeter

KEY — PART IV

1. dynamometer	6. jet	11. flap
2. catapult	7. ozone	12. bazooka
3. torque	8. shot	13. tracker
4. airscrew	9. rocket	14. propellant
5. fin	10. thrust	15. trajectory

KEY — PART V

1. aerodynamics	6. turbo	11. sound
2. oxygen	7. pulsejet	12. jet
3. motion	8. alcohol	13. ionosphere
4. eighty	9. propulsion	14. Megaroc
5. motor	10. catapult	15. curvature

KEY — PART VI

1. reciprocator	6. fuselage	11. carburetor
2. jet	7. friction	12. Boxer
3. gyro	8. oxygen	13. Whittle
4. nineteenth	9. Bell	14. two
5. tunner	10. sound	15. liquid

KEY — PART VII

1. 500	6. reaction	11. skyrocket
2. charcoal	7. twenty-five	12. eighty
3. 25	8. brass	13. thrust
4. Battery	9. five	14. analyzer
5. six	10. Whittle	15. bazooka

TEST — USE OF HAND TOOLS IN AUTOMOTIVE SHOP

WILLIAM H. BOWERS
High School
Tuckahoe, N. Y.

Name..... Date..... Score.....

Read before you start: This test consists of 96 statements, some correct, others wrong. If, in your judgment, the statement is correct, place a *T* before it. If the statement is wrong, place an *F* before the statement. When computing your score, deduct 2 per cent for each statement answered incorrectly. Fill in name, date, and score.

( ) 1. Thousands of years ago man had no tools except his knife, fork, and sword.

( ) 2. The man with the strongest hands owned the best tools.

( ) 3. The first hammer was a stone fastened to the end of a stick.

( ) 4. Today we have powerful machines, some of them six stories high.

( ) 5. Through the development of complicated machine tools the hand tool has lost its importance.

( ) 6. The hand tool is not used in mass production.

( ) 7. The portion of the screw driver that you grip is called the shank.

( ) 8. A screw driver should be used only to loosen or tighten screws.

( ) 9. The screw driver is often used as a pry or pinch bar.

( ) 10. The tip of a screw driver is not hardened.

( ) 11. If the shank of a screw driver is not straight it is hard to keep the blade centered in the slot of the screw.

( ) 12. Most of the screw drivers used for automotive work are made with the shank going all the way through the handle.

( ) 13. All of the new type plastic handled screw drivers are unbreakable.

( ) 14. The tip of a correctly ground screw driver blade should have the sides of the blade practically parallel.

( ) 15. The Phillips type screw driver is extensively used by wood pattern-makers.

(Continued on next page)

QUESTIONS AND ANSWERS ABOUT

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(Continued from previous page)

( ) 16. A Phillips head screw has only one slot.

( ) 17. The current to a spark plug is high in voltage but low in amperage and will ruin your screw driver if you use it to find out which spark plug is missing.

( ) 18. The ball-peen hammer is the one used most by carpenters.

( ) 19. The flat portion of the head is called the peen.

( ) 20. Ball-peen hammers are classed according to the weight of the head, without the handle.

( ) 21. The eye or hole in the hammer head is made with a slight taper in both directions from the center.

( ) 22. The plastic hammer is very unpopular with mechanics.

( ) 23. It is advisable to clean your hammer with fuel oil frequently.

( ) 24. The pliers most commonly used in automotive work are the 4-in. combination slip joint pliers.

( ) 25. Some combination pliers are made with a side cutter for cutting wire and cotter pins.

( ) 26. Loosening or tightening nuts is best done with the pliers.

( ) 27. Solid, nonadjustable wrenches with openings in each end are called open end wrenches.

( ) 28. The average, good wrench set consists of about 18 wrenches.

( ) 29. The size of the opening between the jaws determines the size of an open end wrench.

( ) 30. Open end wrenches have the head and opening at an angle to the body.

( ) 31. The angle on an open end wrench is usually either 26 or 60 degrees.

( ) 32. Special types of open end wrenches have the angle of the opening at 75 degrees.

( ) 33. A tappet wrench is heavy with a short handle.

( ) 34. Adjustable wrenches are made with a short handle.

( ) 35. The angle of the opening to the handle on an adjustable wrench is 22½ deg.

( ) 36. The monkey wrench has been replaced almost entirely by the large adjustable wrench.

( ) 37. A pipe wrench is used on round objects only.

( ) 38. A 6-in. pipe wrench takes pipe from ⅛ to ⅞ in.

( ) 39. Box wrenches can be operated in very close quarters.

( ) 40. A wrench with 12 notches arranged in a circle is called a 12-point wrench.

( ) 41. The sides of a box wrench are very thick.

( ) 42. A "slugging" wrench or "striking" wrench is a type of box wrench, very heavy and strong, which can be struck with a hammer.

( ) 43. The modern socket wrench differs very little from the earlier types.

( ) 44. The early sockets were small and light with thin walls.

( ) 45. The early type socket wrench was six-sided or hexagonal.

( ) 46. Inside the head of the ratchet handle on a socket wrench is a pawl which fits into one or more of the ratchet teeth.

( ) 47. The socket must be raised off the nut to get another "bite."

( ) 48. When unscrewing a nut with a socket wrench the lever is flipped to the right.

( ) 49. Speed handles, sometimes called *speeders* or *spinners*, are convenient for many jobs such as removing oil pan screws.

( ) 50. The speed handle is worked like the brace which a woodworker uses.

( ) 51. A "torque" wrench is an accessory for a socket wrench which measures the amount of pull put on the wrench.

( ) 52. All of the best quality socket wrenches are made of cast iron, then nickel plated.

( ) 53. Grit, unless frequently removed, will ruin any wrench or tool.

( ) 54. Socket wrench sets with a ¼-in. drive end are used for average work.

( ) 55. A setscrew wrench resembles the letter C.

( ) 56. The trade name for a setscrew wrench is Allen.

( ) 57. Setscrew wrenches are made in only two sizes.

( ) 58. The hook spanner wrench is for a round nut which has notches cut in the outer edge.

( ) 59. All hook spanners are adjustable.

( ) 60. An end spanner wrench has a pin in place of a lug and fits into notches in the nut.

( ) 61. Use the socket wrench when working on brake rods, cable ends, clutch and transmission control rods, and fuel lines.

( ) 62. A cold chisel is used for cutting metal and also for wood turning.

( ) 63. Cold chisels are usually made from tough high carbon steel, forged into a hexagonal or octagonal shape.

( ) 64. The width of the cutting edge of a cold chisel denotes its size.

( ) 65. The cape chisel which is quite narrow in width, is used to cut keyways and narrow grooves.

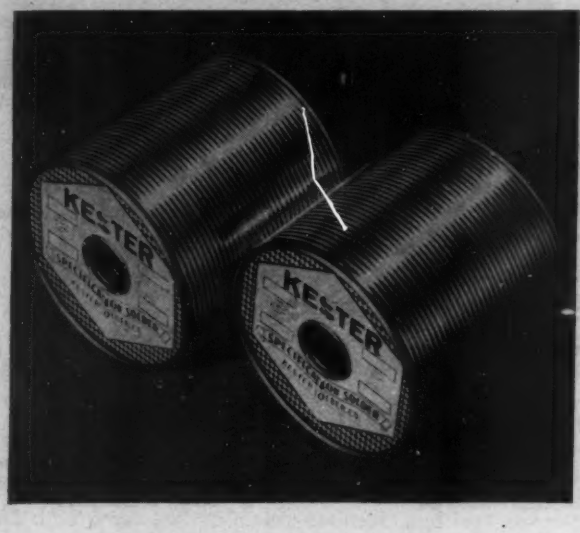
( ) 66. After the cutting edge of a chisel has been ground it is hardened only.

( ) 67. When chipping metal, the depth of the cut is controlled by the angle at which you hold the chisel.

( ) 68. Always try to take a deep cut, about three sixteenths at a time.

( ) 69. When using a chisel for chipping always wear black glasses to protect your eyes.

(Continued on page 44A)



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BENCHES — plain or with drawers, for tools and equipment, or with compartments for the storing of wiring panels. Preferably they should have electrical outlets
BITS
- *a*) Auger, ¼ in. to 1 in. by 16ths
- *b*) Auger, 11/16 in., 18 in. long
- *c*) Drill, for wood, square shank, ⅛ in. to ½ in. by 16ths
- *d*) Expansion
- *e*) Extension, 18 in.
- *f*) Screw driver, ¼ in.

BLACKBOARD — permanent or portable
BLOWTORCHES — 1-qt. size
BOOKCASE
BRACES — ratchet type, 8-in. swing
BULLETIN BOARD
CABINETS — wood or metal for filing class records, instruction sheets, drawings, etc.
CHAIRS — teacher's and tablet arm
COMPASS SAW
COIL
- *a*) Spreader
- *b*) Taper
- *c*) Winder

DESK — teacher's, with drawer compartments
DRILL
- *a*) Breast
- *b*) Concrete, ⅜ in., ½ in., ¾ in., 1 in.
- *c*) Hand
- *d*) Portable, electric
- *e*) Twist, 1/32 in. to ½ in. by 32nds

DRILL PRESS
- *a*) Bench, hand, or power driven
- *b*) Heavy, power driven

FILES
FIRST-AID CABINET AND SUPPLIES
HACK SAW
- *a*) Blades, 10 in., 24 tooth
- *b*) Frames, adjustable

HAMMERS
- *a*) Claw, 12 oz.
- *b*) Machinist's, ball peen

HICKEY — ½ in. and ¾ in.
LATHE
- *a*) Engine, 10-in. or 12-in. swing, 6 ft. or 8 ft. long
- *b*) Speed

PLIERS
- *a*) Gas, 6½ in. and 8 in.
- *b*) Side cutting, 6 in.

PUNCH — for metal molding
PUNCHES — assorted
REAMERS
- *a*) Pipe burring, ¼ in. to 1 in.
- *b*) Pipe burring, ½ in. to 2 in.

RULES
- *a*) 48 in. zigzag
- *b*) 72 in. zigzag

SCREW DRIVERS — 3 in., 5 in., and 8 in.
SHEARS — for cutting metal molding
SOLDER DIPPERS
SOLDERING COPPERS
- *a*) Assorted
- *b*) Electric
- *c*) Handles

STOCKS AND DIES — for pipe threads, ½ in. to 1 in.
VISES
- *a*) Machinist's, 4 in.
- *b*) Pipe

WRENCHES
- *a*) Adjustable, 6 in. and 8 in.
- *b*) Pipe, 10 in., 12 in., and 14 in.
- *c*) Socket, combination

Electrical Shop—Supplies

ABRASIVE CLOTH — Aluminum oxide, 1, 1½, and 2 in. wide
ARMORED CABLE
- *a*) 2 wire, No. 14, single strip
- *b*) 3 wire, No. 14, single strip
- *c*) Box connectors

ATTACHMENT PLUG
BAR HANGERS
BATTERIES — dry cells
BATTERY ACID — 1.300
BATTERY SEALING COMPOUND
BOX CLEATS
BRADS — ¾ in., No. 19, and 1½ in., No. 16
BRAKE LINING — ¼ by 2 in.
BRUSHES — carbon, for motors and generators
BURGLAR CONTACTS
- *a*) Open circuit
- *b*) Closed circuit

BUSHINGS
- *a*) Loom, No. 1 and No. 2
- *b*) "Jiffy" loom No. 2

BUZZERS
CLEATS — unglazed porcelain, 2 wire
CLIPS — test, with insulators, Universal, Nos. 22, 23, 24, and 25
COMMUTATOR CEMENT
CONDUIT
- a) Bushings, ½ in., ¾ in., and 1 in.
- *b*) Box connectors, for flexible
- *c*) Couplings, for flexible
- *d*) Lock nuts, ½ in., ¾ in., and 1 in.
- *e*) Rigid, ½ in., ¾ in., and 1 in.

CONDULET
- *a*) Fillings, ½ in., LL, LR, and LB
- *b*) Covers, ½ in., blank

DOOR OPENERS — mortised
FISH PAPER — .0125 in. thick
FIXTURES — brass chain, suspension
FIXTURE STUDS
FUSES
- *a*) Plug type, renewable, 125 volt, 15 amp.
- *b*) Cartridge type, renewable, 125 volt, 30 amp.
- *c*) Renewals for plug fuses
- *d*) Renewals for cartridge fuses

GROUND CLAMPS — ¾ in. to 1 in., assorted
HICKEY GRIPS — ½ in. and ¾ in.
LAMPS
- *a*) Carbon, 220 volt, 60 watt
- *b*) Mazda, selected as wattages and voltages
- *c*) Guards for brass sockets

LEATHER NAIL HEADS
LUGS — 25 and 50 amp.
LUMBER — 2 by 4 in. by 14 ft., No. 1, white pine dressed, 4 sides
MOLDING
- *a*) Metal
- *b*) Metal, fittings — crosses, T's, internal elbows, junction boxes, switch bases, keyless receptacles, snap switches

NAILS — roofing
NUTS — iron, 4–36, 6–32, 8–32, 10–24, 12–24, 10–32, 14–20
OUTLET BOXES — 4 in. square, with one round blank cover, and one cover with bushed opening
PIPE STRAPS — galvanized, ⅜ in., ½ in., ¾ in., and 1 in.
PUSH BUTTONS
- *a*) Return call, 3 point
- *b*) Single

RECEPTACLES
- *a*) Flush, duplex
- *b*) Porcelain cleat, 660 watt, 250 volt
- *c*) Concealed
- *d*) Covers

RECTIFIERS — Tungar, for charging from 1 to 12, 6- and 12-volt batteries
RELAYS — Dixie
RESISTANCE BOARDS — for testing
RESISTANCE UNITS — 125-ohm
RHEOSTATS
- *a*) Compression, 275 watt
- *b*) Field, for shunt and compound motors

ROSETTES — wood
ROTARY CONVERTER — 5-kw. capacity, 3 phase a.c., 110 volt d.c.
SCREWS
- *a*) Anchors, 8/32, 10/24, 12/24, 14/20
- *b*) Machine, roundhead, 4–36 by ¼ in., 6–32 by ⅜ in., 6–32 by ½ in., 8–32 by ⅜ in., 8–32 by ½ in., 8–32 by 1 in., 10–32 by ⅜ in., 10–24 by ⅜ in., 10–24 by ¾ in., 10–32 by ¾ in., 12–24 by 1 in.
- *c*) Machine, brass, roundhead, 4–36 by ¼ in., 6–32 by ½ in., 6–32 by ¾ in., 8–32 by ½ in.
- *d*) Wood, flathead bright, No. 5 by ¾ in., No. 8 by ½ in., No. 8 by ¾ in., No. 8 by 1 in., No. 7 by 1½ in., No. 8 by 1½ in., No. 7 by 2 in.
- *e*) Wood, roundhead blued, No. 7 by 1 in., No. 8 by 1½ in., No. 10 by 1½ in., No. 7 by 2 in.

SLEEVING — No. 1, white; No. 1, blue; and No. 1, red
SOCKETS
- *a*) Brushed, brass pull chain, keyless, key
- *b*) Porcelain, keyless, with caps
- *c*) Porcelain, key, with caps

SOCKET CAPS — ¼ in. and ⅜ in. bushed
SOLDER WIRE — 50/50, size No. 10
SOLDERING PASTE — 2 oz. cans, noncorrosive
SOLDERING SALTS — 1-oz. cans, noncorrosive
SPEED COUNTERS — 0–9999
SPLIT KNOBS — porcelain
SPRING BALANCES — 0–30 lb.

(Continued on page 46A)

(Continued from page 42A)

( ) 70. Always chip in a direction that is toward you, rather than away from you.

( ) 71. When grinding a chisel hold it against the wheel with very little pressure to avoid overheating.

( ) 72. Hardening and tempering a chisel is a job that should be done only by someone with considerable experience.

( ) 73. It is a very dangerous custom to use a cold chisel whose head is *mushroomed*.

( ) 74. The correct tool to use in removing a broken stud is the diamond point chisel.

( ) 75. Starting punches, sometimes called *drifts*, are made with a long gentle taper which extends from the tip to the body of the punch.

( ) 76. A drift punch is used to knock out rivets after the heads have been cut off.

( ) 77. The center punch is always used to mark the location of a hole that is to be drilled.

( ) 78. *Wandering* is a term used in connection with a starting punch.

( ) 79. The point on a center punch is ground at a 90-deg. angle.

( ) 80. There are more than 37 different types of files.

( ) 81. Files may be either single or double cut and are further classified according to the grades of coarseness or fineness.

( ) 82. The tapered end that fits into the handle of a file is called the heel.

( ) 83. A file with a single row of parallel teeth is called a railroad file.

( ) 84. Files which have one row of teeth crossing another row in a crisscross pattern are called double-cut files.

( ) 85. The terms used to indicate the coarseness of a file are: rough, coarse, bastard, second-cut, smooth, and dead smooth.

( ) 86. The teeth on a file are made to cut in one direction only — when the

(Continued on page 48A)

DESIGN FOR EDUCATION

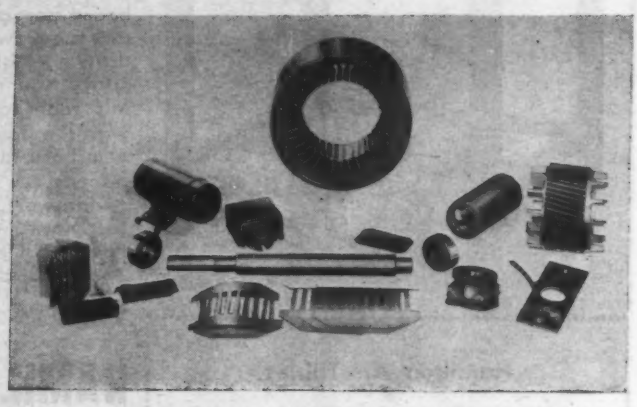
. . . a General Electric plan to help the teacher

THE GUIDANCE of G-E engineers, the facilities of G-E factories and laboratories are offered by General Electric's Educational Service to help you lay out school laboratories, obtain free technical literature, and select proper equipment. This service also directs the design and manufacture of apparatus especially suited for the school laboratory and work shop. Three of these educational equipments are pictured and described below:

FRACTIONAL H-P MOTOR KITS

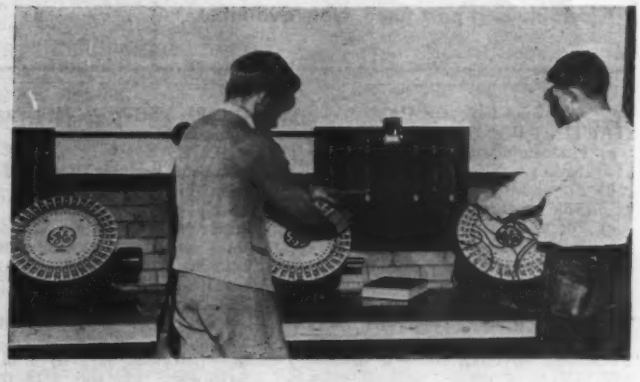
STUDENTS learn by doing, and General Electric construction projects give them an excellent opportunity. These are not merely assembly kits but are projects which require students to use with mechanical skill such tools as the lathe and drill press and to make, connect, and test the motor windings. And these kits may be had for less than half the cost of commercial motors of the same size and rating. Three of these projects are immediately available:

Project	Cat. No.	Ask for Bulletin
¼ h-p, single-phase motor	327X1	GEA-3514A
½ h-p, single-phase motor	327X2	GEA-3526
½ h-p, three-phase motor	327X3	GEA-3542



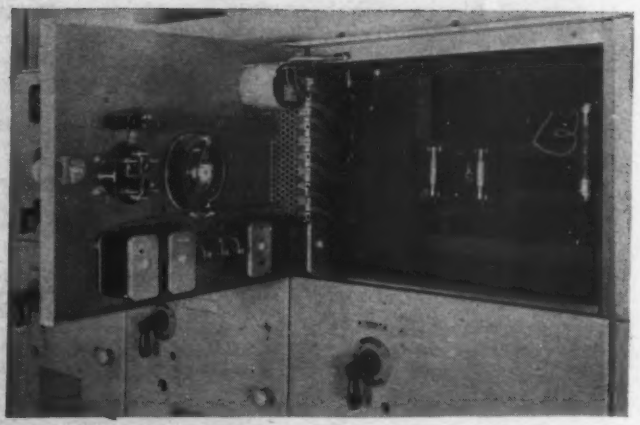
72-TERMINAL INDUCTION MOTOR

ILLUSTRATING the electric and magnetic circuit arrangment, this 36-coil induction motor also shows the common methods of lap winding, phase grouping, coil spacing, and coil connections. It may be connected for four-, six-, or eight-pole operation from either a 2- or 3-phase power source. The 36 stator slots have all 72 leads brought out to a durable, circular terminal board. This board, so marked that the location of all coil ends may be easily traced from their respective terminals, shows schematically every rotor bar as well.



LABORATORY SWITCHBOARD

THIS ENTIRELY NEW, thoroughly modern switchboard enables students to work with the very latest designs of circuit breakers, instrumentation, and metal-enclosed switchgear. Affording maximum safety, it provides, by means of hinged front panels, drawout air circuit breakers, hinged rear doors, and interior illumination, the complete accessibility so essential for proper instruction.



Additional specially constructed equipment is available. Still more is on the drawing board. Catalogs, descriptive bulletins, and other publications covering virtually every line of General Electric apparatus may be had on request. For such bulletins and for complete information regarding any electrical equipment in which you are interested, address your nearest G-E sales office or the Educational Service Division, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

"SIMPLE ADDITION" FOR THE DRAFTING ROOM

V-1620

The basic Hamilton Drawing Table shown at left becomes, by the "simple addition" of a separate unit for drawing board storage and a separate unit for drawers, the complete drawing table shown at right above. Your mechanical drawing room can be equipped with the basic tables only, or with basic tables plus accomodations for drawing boards, or drawers, or both. Write for more information about this versatile Hamilton Table. Ask for Circular 27.

V-1620 with V-1621 and V-1623

Hamilton Art Tables

Modern tables, with part of top adjustable and part fixed. Now available.

HAMILTON MANUFACTURING COMPANY

TWO RIVERS, WISCONSIN

(Continued from page 44A)

STARTING BOXES
- a) For compound motors, various makes
- b) For shunt wound, 1 h.p., 110-volt motors. Overload release
- c) For shunt wound, 1 h.p., 110-volt motors. No voltage release
- d) Starting devices of various makes and principles, for 1 h.p., 3-phase, 220-volt a.c. motors

STORAGE BATTERIES — 6 volt

SWITCH
- a) Battery, 4 point
- b) Bases, porcelain, for 10-amp. switches
- c) Boxes, 2¾ in. deep
- d) Entrance, safety, 2 pole, 30 amp., with 2-branch lighting circuits
- e) Entrance, safety, 3 pole, 30 amp., 250 volt
- f) Flush, push button, S.P., D.P., 3 way, 4 way
- g) Surface, S1, S3, and S4
- h) Knife, type A, D.P.S.T., D.P.D.T., S.P.S.T., and S.P.D.T.
- j) Surface, snap, electrolier
- k) Surface, snap, S.P.D.P., 3 way, 4 way

SWITCHBOARD — as required

TACKS — double-pointed No. 10

TAPE
- a) Friction, ½-lb. rolls
- b) Rubber, ½-lb. rolls

TELEGRAPH SETS — including sounders, keys, and relays

TELEPHONES
- a) Complete bridging, independent phones
- b) Couch vestibule telephones
- c) Receivers, transmitters, induction coils, condensers, and bridging switch hooks

TRANSFORMERS
- a) Bell ringing, 6, 8, 14 volt
- b) Single phase, 110-220 volt, S.K.V.A.

TUBES — porcelain, 5/16 by 3 in., 5/16 by 5 in., and 5/16 by 10 in.

TUBING — flexible nonmetallic, ¼ in. and ⅜ in.

WASHERS
- a) Iron, ¼ in. and ⅜ in.
- b) Brass, ¼ in. and ⅜ in.

WIRE
- a) Annunciator No. 18 or No. 20
- b) Fixture, No. 18, single yellow, with marker
- c) Rubber covered, solid copper, No. 10, black
- d) No. 10, white
- e) No. 14, black
- f) No. 14, white
- g) Rubber covered, No. 16, brewery cord
- h) No. 18, lamp cord, green and yellow
- j) S.C.C. copper magnet, enameled, sizes Nos. 16 to 26 inclusive

Electrical Shop — Motor and Testing Equip.

ANNUNCIATORS
- a) Automatic needle drop
- b) Gravity drop
- c) Manual needle drop

ARMATURES — burnt out, for repairing

BATTERY CHARGER — commercial

CIRCUIT BREAKERS
- a) Air, single pole, overload, 25 amp., 550 volt
- b) Air, single pole, underload, 15 amp., 550 volt

CONTROLLERS
- a) For multiple-speed motor
- b) For 1 h.p., 110-volt series motors

GENERATORS
- a) Motor-generator set, 10 h.p., to supply 110-volt d.c. for testing purposes, battery charging, etc.
- b) Generator, 6-volt d.c. coupled to an a.c. motor for 6-volt circuit testing
- c) Auto generators of different makes

GRAVITY CELLS

MAGNETS — testing, 10,000 ohm

METERS
- a) Ammeter, standard, 60 amp., a.c.
- b) Ammeter, standard, 60 amp., d.c.
- c) Ammeter, student, 60 amp., a.c.
- d) Ammeter, student, 60 amp., d.c.
- e) Voltmeter, standard, 0–10 volt,
- f) Voltmeter, standard, 110–220 volt, d.c.–a.c.
- g) Voltmeter, standard, 125 volt, a.c.
- h) Voltmeter, standard, 125 volt, d.c.
- j) Voltmeter, student, 110 volt, d.c.
- k) Voltmeter, student, 110 volt, a.c.
- l) Wattmeter, standard, 110–220 volt, 30–60 amp., d.c.–a.c.
- m) Wattmeter, student, 110–220 volt, 30 amp., a.c.–d.c.
- n) Watt-hour meter, 125 volt, 5 amp., a.c., single phase, various makes

MOTORS
- a) Auto starter, different makes
- b) Burnt out, fractional h.p., 110 volt, 60 cycle, for repairing
- c) Compound, 1 h.p., 110 volt, d.c.
- d) Multiple speed, 1 h.p., 3 phase, 220 volt
- e) Series, 1 h.p., 110 volt, d.c.
- f) Shunt, 1 h.p., 110 volt, d.c.
- g) Split phase and repulsive, a.c., 110 volt, single phase, assorted
- h) Split phase induction motors, fractional h.p., 110 volt, 60 cycle, different makes
- j) 3 phase, 1 h.p., a.c., 220 volt, various makes
- k) 3 phase, 2 h.p., 220 volt, a.c., various makes
- l) Universal, fractional h.p., 110 volt, different makes
- m) Universal, variable speed, ⅓ h.p.

PLATFORM SCALE — 100 lb. capacity

The World's STANDARDS OF ACCURACY

for Instruction, Research, Industry

The widespread use of WESTON instruments in vocational education has become a fixed principle...primarily because these are the measurement standards so widely used throughout industry. Thus the student becomes thoroughly familiar with the instruments he will use throughout his industrial career. They are preferred, too, because they inspire students to be more exacting in their work, and because they represent a truly sound investment...combining ruggedness, dependability and long life.

Following is a condensed listing of the WESTON instruments available . . . also are illustrated a few of the models most widely used in educational work. Complete information on any WESTON instrument is available and will gladly be sent on request. Write to . . . Weston Electrical Instrument Corporation, 595 Frelinghuysen Avenue, Newark 5, New Jersey.

PORTABLE INDICATING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

PANEL MOUNTING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

RELAYS
Sensitive and Power Uses — Current and Voltage Types

INSTRUMENT TRANSFORMERS
Portable — Potential and Current

AIRCRAFT INSTRUMENTS
Tachometers, Temperature Indicators, Radio Compass Indicators, Ammeters, Voltmeters, etc.

ELECTRIC TACHOMETERS
A.C. and D.C. Types — Remote Indicating

LABORATORY STANDARDS
Voltmeters, Ammeters, Wattmeters

SPECIALIZED TESTING EQUIPMENT
Power Analyzer, Photoelectric Potentiometer, Battery Testing Instruments

SERVICE EQUIPMENT
Tubecheckers, Analyzers, Ohmmeters

PHOTOELECTRIC CELLS
"Photronic" Cells — Dry Disc Type

PHOTOELECTRIC CONTROL DEVICES
"*Photronic" Illumination Controls

LIGHT MEASURING DEVICES
Illumination Meter, Foot Candle Meters, Sight Meter, Exposure Meters

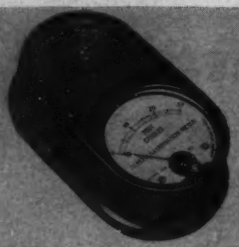
TEMPERATURE INDICATING INSTRUMENTS
ELECTRICAL TYPE — Remote Indicating
BIMETALLIC TYPE — Laboratory, Industrial

INSTRUMENT ACCESSORIES AND PARTS
Shunts, Cables, Resistors, Switches, Binding Posts, Leads, Multipliers, Adapters, Radio Plugs, etc.

STANDARD CELLS

**Photronic—A registered trademark designating the photoelectric cells and photoelectric devices manufactured exclusively by the Weston Electrical Instrument Corporation.*

WESTON *Instruments*



Model 703
Sight Meter

Direct-reading pocket size meter calibrated to measure light values in foot-candles, and "seeing tasks." Equipped with Weston VISCOR filter it measures the visual intensity of all common lighting sources without correction factors.

Model 430
Portable, Precision A. C. and D. C. Instruments

Universally used in schools and industry wherever rugged, portable instruments are required for general testing. Hand calibrated, mirror scales with knife-edged pointers.

Model 779 Type 1
Super-Sensitive Analyzer

Small, light, sturdy . . . has 25 carefully selected voltage, current, resistance and decibel ranges. Ideal for measurements in tube circuits, transmitters, electronic controls, audio and communications equipment, condenser leakage, etc., etc. D.C. sensitivity 1000 or 20,000 ohms per volt.

Model 489 and 528
Small A. C. and D. C. Instruments

Small, sturdy, inexpensive . . . for all-around A.C. and D.C. testing where moderate accuracy is sufficient. Available in Voltmeters, Ammeters, Milliammeters. A.C. models available in single, double and triple ranges.

Model 375
Student Galvanometer

Ideal for schools, where durability and moderate cost are essential. Sensitivity approximately 22 microamperes per division, resistance about 23 ohms. Zero center scale, calibrated 30-0-30 in millimeter divisions. Other sensitive models also available.

Model 280
Miniature D. C. Instruments

Miniature precision D.C. instruments, with hand calibrated mirror scales and knife edged pointers. Available as voltmeters, ammeters, voltammeters, milliammeters and millivoltmeters.

Model 798
Tube Checker

—proportional mutual conductance tube checker — tests all commonly used receiving tubes. Scale calibrated "Good-Bad" as well as mutual conductance. Includes various AC and DC voltage, DC current, and resistance ranges for circuit checking.

Woodworking Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BENCH
- *a*) Shop, with hardwood tops, 1¾ in. or over in thickness, the top to project far enough to allow a rapid-acting or continuous-screw vise to be attached.
  It may be well to order a 1-in. birch or maple board wide enough to cover the working face of the bench at the time of buying the benches. This board can then be fastened to the top proper with screws and may be conveniently replaced when worn. The benches should be made of thoroughly kiln-dried lumber throughout. They may be either plain or of 6-drawer type
- *b*) Glue
- *c*) Stain, with metal-covered top
- *d*) Teacher's demonstration

BLACKBOARD — permanent or portable

BOOKCASE

BULLETIN BOARD

CABINETS — wood or metal for filing class records, instruction sheets, drawings, finishing materials, hardware, small tools, supplies, etc.

CHAIRS — teacher's and tablet arm

CORE OVEN — for patternmaking class

DESK — teacher's, with drawer compartments

FURNACE — for melting soft metals (for patternmaking class)

GLUEPOT — 1 qt. or 2 qt., electric, gas, or steam heat

GLUE WARMER OR COOKER — 1- to 5-gal. capacity

GRINDER
- *a*) Automatic knife, direct-motor-type. Size to suit largest knife used in school shop, complete with water pump, grinding wheel, and automatic stops
- *b*) Bench, hand or power
- *c*) Bench, motor-in-head. Motor bearings to be completely housed, wheels to be equipped with safety flanges and carefully guarded throughout. One fine-grit, and one coarse-grit wheel
- *d*) Revolving oilstone, pedestal type, with one fine and one coarse oilstone

JOINTER
- *a*) 6-in. or 8-in. portable jointer. Table to be fitted for rabbetting. Safety-cylinder type, equipped with safety guard
- *b*) 12, 16, or 18 in. direct motor drive, ball bearing. Cylinder to be of safety-head type. Table to be fitted for rabbetting. Jointer to be equipped with safety guard

LATHES
- *a*) 6-in. to 16-in. motor-in-head, motor-in-base, or belt-driven speed lathe, to take 24, 36, 48, 60, or 72 in. between centers. Each to be complete with cup center, spur center, faceplate, rosette chuck, tool rests, and center drift for head block
- *b*) Patternmakers', with end faceplate provision. Lathe to be of direct-motor-drive type, equipped with variable-speed motor, faceplates and floor stand. (For patternmaking class)

MORTISER
- *a*) Direct-motor-drive, or belt-driven, hollow-chisel mortiser, foot feed. Table to be of the tilting type with hold-down clamps and stop rod
- *b*) Portable, vertical, hollow-chisel mortiser, bench type

PLANER — 12, 18, 20, 24, or 30-in., motor or belt-driven, single-surface planer. Safety-head cylinder, three-knife type, fitted with good-grade steel knives. Knife-setting and jointing device complete with bar should be mounted on machine if possible

SANDER
- *a*) Belt, direct motor drive
- *b*) Disk, motor or belt driven
- *c*) Oscillating spindle, motor driven
- *d*) Portable, hand-plane type, direct motor drive
- *e*) Vertical spindle and disk sander

SAWS
- *a*) Band saw, 20 to 36 in., motor drive. Upper and lower wheels to be completely guarded. Table to tilt to 45 deg.
- *b*) Combination, band saw, crosscut saw, ripsaw, and mortiser. Machine to be completely guarded
- *c*) Cutoff, pedestal or swing type to be fitted with 12-in. to 16-in. saw
- *d*) Filing machine, direct motor drive
- *e*) Jig, direct motor or belt driven
- *f*) Portable band saw, 14 to 20 in. ball bearing, motor driven
- *g*) Saw bench, directly connected to motor, and to have both rip and crosscut saws. Rip and crosscut gauges also to be provided
- *h*) Universal saw bench, 14 to 16 in., motor driven
- *j*) Variety saw bench, motor driven, tilting table, with universal sliding table. The arbor is to be fitted for a dado head, and the table is to be slotted accordingly. The saw is to be equipped with ripping fence and miter cutoff gauges

SHAPER
- *a*) Motor drive, single or double spindle. Table to be equipped with removable center plate
- *b*) Portable shaper or router with a suitable selection of cutters

TENONER — single end, with coping heads and cutoff saw

VISES — rapid-acting or solid-nut type woodworking-bench vises, 7 to 10 in.

WOOD TRIMMERS — complete with all gauges and taper-pins. Base of trimmer to be slotted and laid out for degree settings (for patternmaking class)

Woodworking—Small Tools

AWLS — brad, assorted sizes

BEVELS
- *a*) Protractor
- *b*) Sliding T, 8 in.

BITS
- *a*) Auger, 3/16 in. to 1 in. inclusive, by 16ths
- *b*) Auger, 3/16 in. to ½ in. inclusive, by 16ths
- *c*) Braces, ratchet type, 8-, 10-, 12-, or 14-in. sweep
- *d*) Countersink, for wood, rose pattern, ½ in. and ⅝ in.
- *e*) Dowel, square shank, ¼ in., 5/16 in., ⅜ in., ½ in., ¾ in.
- *f*) Expansive, ⅜ in. to 1½ in.
- *g*) Expansive, ⅞ in. to 3 in.
- *h*) Forstner, square shank, ¼ in. to ½ in. inclusive, by 16ths
- *j*) Screw driver, square shank, ¼ in., 5/16 in., ⅜ in.
- *k*) Twist drill for wood, square shank, 1/16 in. to ⅜ in. inclusive, by 16ths
- *l*) Twist drill, straight shank, 1/16 in. to ⅜ in., inclusive, by 32nds

BLOWTORCH

BROOMS

BRUSHES
- *a*) Bench duster, 10 in.
- *b*) Floor
- *c*) Glue, round, 1½ in. and ¾ in.
- *d*) Glue, round, 1½ in.
- *e*) Marking, camel's hair, No. 1 and No. 2
- *f*) Varnish, flowing, 2 in. and 2½ in.
- *g*) Varnish, flat, ½ in., ¾ in., and 1 in.

BURNISHERS — oval or round

CAN OPENER

CARVING TOOLS
- *a*) Sets containing 6 tools
- *b*) Sets containing 12 tools

CHISELS
- *a*) Cold, machinists', ⅜ in. and ½ in.
- *b*) Mortising chisel and bits, ¼ in. to 5/8 in. by 16ths
- *c*) Socket firmer, bevel edge, ½ in., ¼ in., ½ in., ¾ in., 1 in., and 1½ in.
- *d*) Socket firmer, plain edge, ½ in., ¾ in., and 1 in.
- *e*) Tanged firmer, bevel edge, ⅛, ¼, ½, ¾, 1, and 1¼ in.

CLAMPS
- *a*) Bar, 24, 36, 48, and 60 in.
- *b*) Hand-screw, 4, 5, 6, 7, 8, 10, 12, and 14 in.

(Continued on page 50A)

(Continued from page 44A)

file is pushed forward.

( ) 87. A file card always has a *scorer* attached to it.

( ) 88. Practically all hack saws are now made with an adjustable frame designed to take blades which are 4, 6, 8, 10, or 12 in. long.

( ) 89. All adjustable hack-saw frames are made so the blade can be installed in a vertical or horizontal position.

( ) 90. For efficient cutting in metals of average hardness the hack saw should be worked at the rate of 80 to 90 strokes per minute.

( ) 91. The 18-tooth hack-saw blade is suitable for all sawing except thin metal, such as tubing.

( ) 92. The feeler gauge is the tool that enables an automotive mechanic to work to thousandths of an inch.

( ) 93. There is a very close resemblance between a feeler gauge and a micrometer.

( ) 94. The micrometer caliper, more often called a *mike*, measures in thousandths of an inch.

( ) 95. There are 25 equal spaces around the tapered edge of the thimble of a micrometer, each space representing one thousandth inch of measurement.

( ) 96. The Ezy-Out screw extractor, which is the most common type used by mechanics, is tapered and has a coarse spiral, resembling a thread, with very sharp ridges.

REFERENCE

The ABC's of Hand Tools, General Motors Corp., Detroit, Mich.

KEY FOR TEST

1. F	17. F	33. F	49. T	65. T	81. T
2. T	18. F	34. F	50. T	66. F	82. F
3. T	19. F	35. T	51. T	67. T	83. F
4. F	20. T	36. T	52. F	68. F	84. T
5. F	21. T	37. T	53. T	69. F	85. T
6. F	22. F	38. F	54. F	70. F	86. T
7. F	23. T	39. T	55. F	71. T	87. F
8. T	24. F	40. T	56. T	72. T	88. F
9. T	25. T	41. F	57. F	73. T	89. T
10. F	26. F	42. T	58. T	74. F	90. F
11. T	27. T	43. F	59. F	75. F	91. T
12. T	28. F	44. F	60. F	76. T	92. T
13. F	29. T	45. T	61. F	77. T	93. F
14. T	30. T	46. T	62. F	78. F	94. T
15. F	31. F	47. F	63. T	79. F	95. T
16. F	32. T	48. F	64. T	80. F	96. T

New

Now you can enjoy famous Delta quality in a machine for teaching heavy-duty operating technique!

Delta* 20" Wood-cutting Band Saw

$325.00 without miter gage, motor, or switch

Takes any type of blade in any size up to 1 inch in width. Maximum height under upper guide is 13½"

Because it's engineered for safety, accuracy, and convenience, the new, low-priced Delta 20" Wood-cutting Band Saw is a practical tool for woodworking instruction purposes. And it is available now!

Delta 20" Band Saw features are among the newest and most advanced in the industry — many of them exclusive with Delta:

- To safeguard students, single-unit welded steel cabinet completely encloses all working parts. Doors provide quick access to wheels and motor.
- Adjustable "three-point mountings" between working parts and welded steel frame help to maintain exact alignment.
- Statically-balanced aluminum wheels are mounted in sealed-for-life ball bearings. Adjustable control on upper wheel helps to maintain proper blade tension for each particular job.
- Wheels are made of aluminum, to reduce flywheel action after motor is shut off.
- Convenient foot-brake is provided on lower wheel.
- Motor is mounted in base on pivot bracket which automatically provides correct belt-tension.
- Dust chute carries away dust and chips . . . can be attached to dust collector.

Your nearby Delta distributor can give you further reasons why it pays to specify Delta 20" Wood-cutting Band Saws on your equipment requisition. See him. Look for his name under "Tools" in the classified section of your telephone directory.

DELTA MANUFACTURING DIVISION
ROCKWELL MANUFACTURING COMPANY
MILWAUKEE 1, WISCONSIN
General Sales Office • 6 NORTH MICHIGAN AVENUE, CHICAGO 2, ILLINOIS

DELTA MILWAUKEE

*Trade Mark Reg. U. S. Pat. Off.

20" x 24" table is rigidly supported on two widely-spaced trunnions. Conveniently tilts 45° to right, 12° to left.

Heavily-ribbed table is slotted to accommodate miter gage. It is also adaptable to use of a rip fence, as shown.

Ball-bearing blade guides, above and below table, are fitted with micrometer adjustment.

• *Free Bulletin! Gives specifications and detailed description of Delta 20" Wood-cutting Band Saw. There's a copy ready for mailing to you. Request it, by coupon below.*

9-38

TEAR OUT COUPON AND MAIL TODAY!

DELTA MANUFACTURING DIVISION
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Send me free copy of Bulletin A-28-3 describing Delta 20" Wood-cutting Band Saw

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Position.....
School.....
Address.....
City..... State.....

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THE NEW STANLEY TOOL CATALOG No. 34
. . . tools for all school shops
FOR WOODWORKING AND FARM SHOPS The most complete line offered by one manufacturer.
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FOR SHEET METAL SHOPS Hammers, chisels, punches, etc.
FOR AUTOMOBILE SHOPS Hammers, chisels, punches, screw drivers, etc.
FOR MACHINE SHOPS Hammers, rules, chisels, punches, levels, etc.
FOR FORGE SHOPS Anvil tools, tongs, hammers, etc.
Visual teaching aids and project plans at cost.
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Educational Dept., 112 Elm St., New Britain, Conn.
STANLEY
Reg. U.S. Pat. Off.
HARDWARE · HAND TOOLS · ELECTRIC TOOLS

(Continued from page 48A)

c) Malleable-iron C, 4, 6, and 8 in.

DIVIDERS — wing, 6 in. and 10 in.

DOWEL PLATE — 6 in. long

DOWELING JIGS — with bushings

DRAWKNIVES — 7 in.

DRILL
- a) Automatic hand, with 8 drill points
- b) Chuck, 0 to 3/8 in.
- c) Hand, 0 to 3/8 in., for round-shank drills
- d) Star, for concrete, 1/2 in. and 3/4 in.

FILES
- a) Auger bit, assorted, 6 in.
- b) Cabinet, 8 in. and 10 in.
- c) Card and brush
- d) Flat, wood, 10 in.
- e) Mill, bastard cut, 12 in.
- f) Round, bastard cut, 12 in.
- g) Taper, slim, 5 1/2 in. and 7 in.

FIRST-AID CABINET AND SUPPLIES

GAUGES
- a) Bit, adjustable
- b) Jointer
- c) Marking, metal or hardwood
- d) Mortise, metal or hardwood
- e) Panel

GLASS CUTTER

GOUGES
- a) Tanged firmer, outside ground, handled, 1/8, 1/4, 1/2, 3/4, and 1 in.
- b) Tanged firmer, inside ground, handled, 1/8, 1/4, 1/2, 3/4, and 1 in.
- c) Spoon, 1/2, 3/4, and 1 in.

HAMMERS — claw, bell faced, 10, 12, 13, and 16-oz.

HATCHET — bench, 4-in. cut

JARS — earthenware, 1-qt. capacity

KNIVES
- a) Jointer, to fit power machine
- b) Planer, to fit power machine
- c) Sloyd, 3-in. blade

LEVELS
- a) Wood, 24 in.
- b) Machinists', 12 in.

MALLETS — hickory, 3 by 5 in. head

NAIL SETS — 1/16 in. and 3/32 in. points

OILERS — bench, 1/3 pt., coppered, best grade

OILSTONES
- a) 1 by 2 by 8 in. in iron box
- b) Gouge slip, medium, 4 1/2 by 2 1/4 by 3/8 by 5/16 in.
- c) Gouge slip, fine, 3 by 2 by 3/8 by 1/8 in.

PINCERS — 6 in. carpenters'

PINCH DOGS — 3/4, 1, and 1 1/4 in.

PLANES
- a) Block, adjustable, 6 in. long, 1 5/8-in. cutter
- b) Circular
- c) Combination, adjustable
- d) Core box
- e) Duplex, fillister and rabbet
- f) Fore, 1/8 in., 2 3/8-in. cutter
- g) Irons, double
- h) Jack, 14 in., 2-in. cutter
- j) Jointer, 24 in.
- k) Round, wood, 1 3/4 in.
- l) Router
- m) Smooth, 9 in., 1 3/4 in. or 2-in. cutter

PLIERS
- a) Roundnose, 5 in.
- b) Side-cutting, 6 in.

PUTTY KNIVES

RASPS — half round, wood, 10 in.

RULES
- a) Board
- b) 1 ft. or 2 ft. graduated by 8ths and 16ths
- c) Shrink, 1/8 in., 3/16 in.

SAWS
- a) Back, 12 in., 14 point
- b) Band, to fit power machine
- c) Compass, 10 in.
- d) Coping, frames
- e) Coping, blades
- f) Crosscut, 9 tooth, 22 in. long
- g) Crosscut, circular for power machine
- h) Dado, 1/8 in. to 1 1/16 in. to fit power-saw arbor
- j) Hack, frames, 10 in. or adjustable
- k) Hack, blades, 10 in.
- l) Keyhole, 10 in., 10 point
- m) Rip, 7 point, 22 in. long
- n) Rip, circular for power machine
- o) Set, 10 points per inch and finer
- p) Set, 10 points per inch and coarser
- q) Turning frame, 14 in.
- r) Turning blades, 3/16 by 12 in., 10 tooth
- s) Miter box, 24 by 4 in. saw, 7-in. capacity at miter

SCRAPERS
- a) Cabinet
- b) Glue, triangular
- c) Veneer, blade, 2 3/4 in. long, handle 11 in. long

SCREW DRIVERS
- a) Cabinetmakers', 4, 6, and 8 in.
- b) Quick return, spiral ratchet

SHOOT BOARD — and plane

SNIPS — tinners', forged steel, 2 1/2-in. cut

SPOKESHAVES — adjustable, raised handle, 10 in. long

SQUARES
- a) Combination, 12 in.
- b) Try-, iron handle, 8 in.
- c) Framing, 2 ft.

STEEL FIGURES — hand cut, 1/8 in.

TAPELINE — 50 ft., steel

TRAMMEL POINTS — adjustable metal frame, steel points

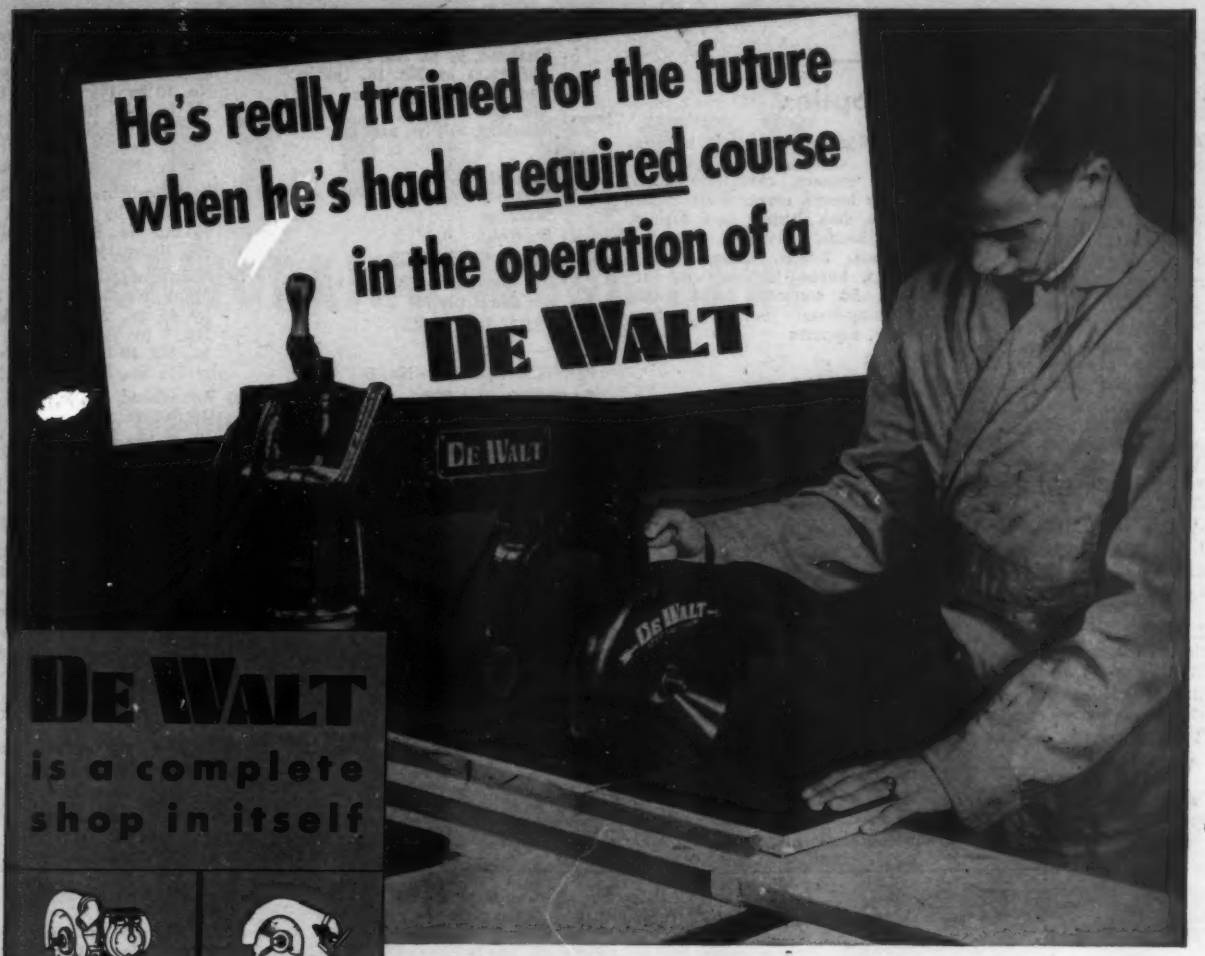
TURNING TOOLS
- a) Calipers, 6 in. inside and outside
- b) Calipers, 12 in. inside and outside
- c) Parting tools, 1/8 in.
- d) Round point, 1/4 in., 1/2 in., 3/4 in.
- e) Spear point, 1/4 in., 1/2 in., 3/4 in.
- f) Square point, 1/4 in., 1/2 in., 3/4 in.
- g) Turning chisels, 1/4 in., 1/2 in., 3/4 in.
- h) Turning gouges, 1/4 in., 1/2 in., 3/4 in.
- j) Turning skews, L.H., 1/4 in., 1/2 in., 3/4 in.
- k) Turning skews, R.H., 1/4 in., 1/2 in.

VISE — 3-in. jaw, anvil face

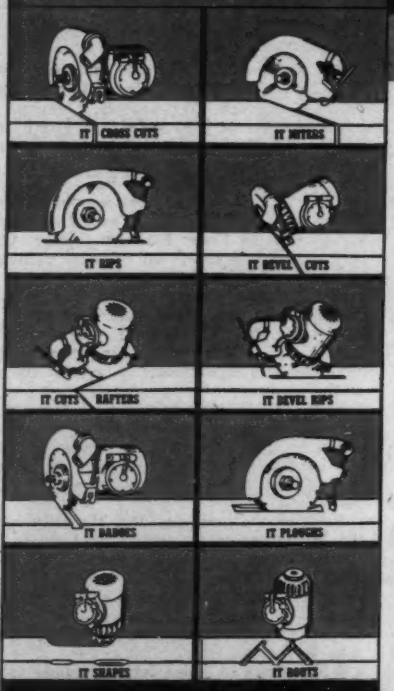
WRENCHES
- a) Adjustable, 8, 10, and 12 in.
- b) Headless setscrew
- c) Pipe, 10 in. and 12 in.
- d) S type or open-end type to fit 1/4-in. to 1-in. N.C. nuts

(Continued on page 52A)

He's really trained for the future when he's had a required course in the operation of a DE WALT



DE WALT is a complete shop in itself



...and with proper tools makes any cut possible!

After the student has completed his basic training course in the use of hand tools, he should have a required course in the operation of DeWalt.

Knowing how to make the fullest use of this flexible, easy-to-operate machine, will give any student a head-start as he prepares for tomorrow's industry.

When he leaves school he will be fully acquainted with a machine that is destined to occupy a prominent place in tomorrow's industry. The perfection of the DeWalt saw has created new methods in cutting wood, making obsolete old-style equipment previously used.

Ask a nearby DeWalt dealer about two DeWalt 16MM movies—one showing the general application of DeWalt—the other showing modern, pre-cutting techniques developed during the war. Write for catalog.

DE WALT, INC.

123 Fountain Avenue **Lancaster, Penna.**

(Continued from page 50A)

Woodworking— Materials and Supplies

ALCOHOL
BENZINE
BRADS — 3/4 in., 1/2 in., and 5/8 in. No. 20; 3/4 in. and 7/8 in. No. 19; 1 in. No. 18; 1 1/4 in. and 1 1/2 in. No. 16; 1 3/4 in. No. 15; 2 in. and 2 1/2 in. No. 14
CARBON PAPER — black
COLORS — dry: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, Vandyke brown, and vermilion
COLORS — ground, in oil or japan: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, rose lake, Vandyke brown, and vermilion
DECALCOMANIA TRANSFERS
DOWEL PINS AND PLATES
DOWELS: hardwood, 3-ft. lengths, 1/4 in., 5/16 in., 3/8 in., 1/2 in., 3/4 in.
ENAMEL
a) Selected colors
b) Undercoater
FILLERS — paste: natural, golden oak, dark oak, and mahogany
FILLETS — leather, 1/4 in. and 1/2 in.
GLUE
a) Casein, hide, best grade cabinet
b) Liquid
HARDWARE: Brackets, buttons, butts, casters, catches, chain, chest corners, chest trimmings, corner braces, corner irons, corner plates, desk fittings, door fittings, escutcheons, fasteners, handles, hangers, hinges, hasps, holders, hooks, knobs, latches, lamp fittings, lid supports, locks, pulls, smoking-stand outfits, springs, stops, supports
HOOKS
a) And eyes
b) Cup
c) Screw and
d) Square screw
LACQUER — black, clear, cobalt blue, ivory, medium green, red, thinner, white, and yellow
LUMBER — Ash, balsa, bass, birch, cherry, cypress, locust, mahogany, maple, oak, poplar, red cedar, red gum, redwood, sap gum, yellow pine, walnut, white pine
In ordering pine, mill run, kiln dried will be found suitable for carpentry, while short, select, kiln dried, 4 in. and wider or No. 1 shop common, kiln dried will be required for cabinetmaking and patternmaking
Hardwood, for furniture, should be specified first and second grade, kiln dried, standard widths and lengths, or short lengths
MOLDINGS
NAILS
a) Common, 6d, 8d, and 10d
b) Flathead, 3/4 in. No. 20, 3/4 in. No. 19, 1 in. No. 18, 1 1/4 in. and 1 1/2 in. No. 16, and 2 in. No. 14
c) Finishing, 4d, 6d, and 8d
OIL
a) Linseed, boiled
b) Linseed, raw
c) Machine
d) Rubbing
OVERLAY CARVINGS
PANEL OR PLYWOOD — 3 ply, 5 ply, and 7 ply
PATTERN LETTERS
PINS — escutcheon
PUMICE STONE — No. 0
RAPPING PLATES
ROTTENSTONE
SANDPAPER — Garnet cabinet paper, 3/0, 2/0, 0, 1/2, 1
Garnet finishing paper, 6/0, 4/0
Garnet paper can also be obtained in rolls of 50 yd. in widths 4 in. up to 48 in. Narrower widths on special order
SCREW EYES
SCREWS
a) Flathead, brass, No. 3 by 3/8 in., No. 4 by 1/2 in., No. 5 by 5/8 in., No. 5 by 3/4 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., No. 10 by 1 1/4 in., No. 10 by 1 1/2 in., No. 12 by 1 1/4 in., No. 12 by 1 3/4 in., No. 10 by 2 in.
b) Flathead, bright, No. 3 by 1/2 in., No. 4 by 1/2 in., No. 6 by 3/4 in., No. 7 by 7 1/2 in., No. 8 by 1 in., No. 10 by 1 in., No. 8 by 1 1/4 in., No. 10 by 1 1/4 in., No. 14 by 1 1/4 in., No. 10 by 1 1/2 in., No. 12 by 1 1/2 in., No. 10 by 1 3/4 in., No. 12 by 1 3/4 in., No. 10 by 2 in., No. 12 by 2 in., No. 14 by 2 in., No. 12 by 2 1/4 in., No. 14 by 2 1/4 in., No. 14 by 2 1/2 in
c) Oval head, brass, No. 5 by 3/4 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., and No. 10 by 1 1/4 in.
d) Roundhead, blued, No. 3 by 3/4 in., No. 3 by 1/2 in., No. 5 by 3/4 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., No. 10 by 1 1/4 in., No. 10 by 1 1/2 in., No. 12 by 1 1/2 in.
e) Roundhead, brass, No 3 by 3/4 in., No. 4 by 1/2 in., No. 4 by 5/8 in., No. 5 by 3/4 in.
SHELLAC
a) Orange, cut 4 lb. to the gal.
b) Sticks, assorted colors
c) White, cut 4 lb. to the gal.
NOTE: Shellac should be kept in glass or earthenware containers
STAINS — oil, spirit or water. Fumed oak, dark oak, golden oak, light oak, mahogany, and walnut
STEEL WOOL — No. 0 and No. 2/0
TURPENTINE
TWINE
VARNISH — coach, flat, remover, spar, and rubbing
WASTE — cotton, white
WAX — bees and finishing
WHITE LEAD

Personal News

R. H. ROBERTS DIES

Richard Hugh Roberts, director of industrial arts and vocational education for the Tulsa public schools, died on Thursday, November 20, 1947, after a protracted illness.

He was born in Burrton, Kans. He received his B.S. degree in 1926 from State Teachers College, Pittsburg, Kans., and his M.S. degree from Columbia University in 1935.

Prior to teaching at Tulsa, Okla., he was director of industrial education in Winfield, Kans. In 1941 he came to Tulsa as a teacher of printing. Later he served as director of the industrial education department of Central High School, and as administrative assistant to R. B. McHenry, director of industrial and vocational education of Tulsa, Okla.

In 1943 he was named area training supervisor for war production and in-plant training for northeastern Oklahoma.

In 1944 he was appointed director of industrial arts and vocational education for Tulsa, succeeding R. B. McHenry, who had resigned.

Mr. Roberts was a member of the summer school faculty of the Oklahoma A. & M. College in 1942. He was a member of Phi Delta Kappa, and of Iota Lambda Sigma educational fraternities.

♦ The increasing significance of industrial education, in a measure, is reflected in the decision of the Indian Government to send RADHA C. DAS, Orissa, India, to Cornell University for the purpose of studying technical education. Mr. Das feels that the educational program in India should be more practical and that students, after completing their basic education, should be able to choose some definite occupation and to secure adequate preparation for it.

Following completion of his study leading toward the Ph.D., Mr. Das intends to return to India and develop a more realistic technical education program there.

Mr. Das received his B.S. degree, with honors, from Andhra University, Waltair, India, and later served as a lecturer in physics in an Indian Government College. Cornell was chosen for study largely because of the increasing attention being given in New York State and at the University to the development of a technical institute program.

♦ MARLAND K. STRASSER has joined the staff of the National Conservation Bureau, accident prevention division of the Association of Casualty and Surety Companies. Mr. Strasser is assigned to the safety education services of the Bureau and will devote most of his time in the field of high school driver education and training.

With the expansion of its driver education program, it is expected that the Association, and the Center for Safety Education which it endows, will conduct training courses for high school teachers in 40 states during the present year.

Statistics recently released by Wisconsin and Delaware, where driver education has been offered in most high schools for several years, show that this instruction produces highly satisfactory results in the reduction of both accidents and traffic violations among young drivers who have received training, the Association reported.

♦ GILBERT E. MCGREW, Camden, S. C., is doing full-time graduate study at the New York State School of Industrial and Labor Relations at Cornell University. Mr. McGrew, a major in Industrial Education, is approaching his M.S. in Ed. and has selected for research study "A Proposed Work Experience Program for the George Junior Republic."

Mr. McGrew formerly was diversified occupations co-ordinator and industrial-arts instructor with the Camden City Schools, Camden, S. C., which position he held since 1937 except for the war period. During the war he was director of civilian personnel for the New Cumberland A.S.F. Depot, at New Cumberland, Pa.

♦ PAUL T. HISER has been appointed assistant professor in the division of industrial education at the Oswego State Teachers College, Oswego, N. Y. He is also supervisor of cadet training, and off-campus teaching.

Mr. Hiser received both his B.S. and M.A. degrees from the Ohio State University. From 1934 until 1937 he taught in the Ross County (Ohio) schools and during this period established industrial-arts departments in three of the schools of the county.

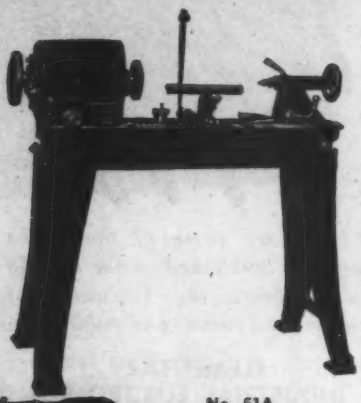
From 1937 to 1940 he was a teacher and supervisor in an experimental center in industrial-arts education in the schools of Grove City, Ohio, and from 1940 until 1942 he was connected with the industrial-arts department of the Oberlin public schools.

Entering the army in 1942, Mr. Hiser attended the Fort Benning Infantry School where he was commissioned. He served in the Caribbean theater and in the Panama Canal Zone and was discharged with the rank of major in 1946. Since his separation from the service he has been chief of personnel training for the Veterans Administration at Dayton Ohio.

♦ SYLVESTER A. MCCARTHY, former instructor of metallurgy and chemistry at the West Allis School of Vocational and Adult Education, has signed a four-year contract with the Afghan government to teach chemistry and physics either at Kabul teachers college, or at Habiba college, both in Kabul Afghanistan.

(Continued on page 54A)

"OLIVER"
WOODWORKING MACHINERY

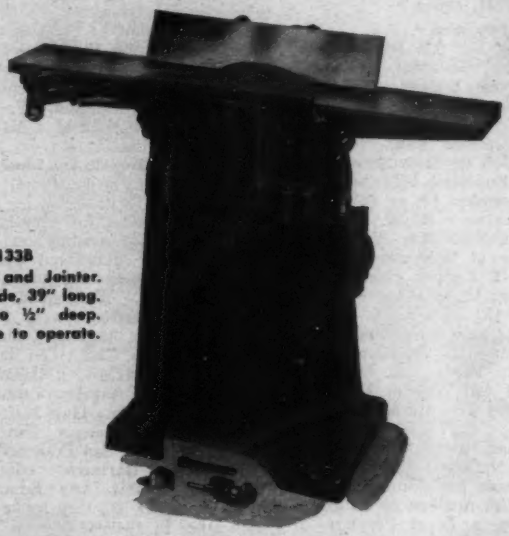


No. 51A
Speed Lathe has four speeds, 570, 1140, 1725, 3450 R.P.M. New type slide control. 48 inch bed. 24 inch turn between centers.

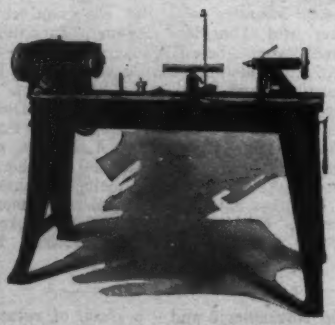
MAKE TRAINING SAFER, EASIER and FASTER

Safety is the keynote of "Oliver" design. Students are protected from injury by the newest and best safety devices. For performance, "Oliver" machines have those plus features that make them withstand hard usage of beginning woodworkers over a period of many years.

No. 399
Single Surface Planer takes stock to 18 inches wide, 6" thick, 8½" short when fed singly. Power driven feed rolls handle 15 to 35 feet a minute.



No. 133B
Hand Planer and Jointer. Table 6¼" wide, 39" long. Rabbits up to ½" deep. Easy and safe to operate.



No. 159
Motor Driven Speed Lathe. Speeds from 800 to 2400 R.P.M. Starts only at low speed. 12" swing, 36" between center.

Special co-operation extended to school shop executives in organizing, planning and equipping woodworking shops. Inquiries and correspondence relative to requirements are solicited.

The Oliver line of equipment includes: Wood Lathes, Sanders (Belt, Disk or Spindle), Boring Machines, Mortisers, Tenoners, Shapers, Circular Saw Benches, Band Saws, Band Saw Brazers, Jig Saws, Surface Planers, Jointers, Wood Trimmers, Oilstone Tool Grinders, Woodworkers Vises, Glue Heaters, Knives, Saws, Metal Spinning Lathes, Electric Glue Heaters.

Write for circulars illustrating any or all of these machines

OLIVER MACHINERY COMPANY
Grand Rapids, Mich., U. S. A.

1848
1948

• *Here are some of the books we have published so far in 1948 to celebrate the beginning of our second century of publishing.*

ELEMENTARY INDUSTRIAL ELECTRONICS
WELLMAN

A beginner can understand this "feet-on-the-ground" book on electronics theory and applications. It is written not from the viewpoint of an engineer, but directly to students, electrical maintenance men, and workers in allied fields. Use of mathematics is kept to a bare minimum.

SWOOPE'S LESSONS IN PRACTICAL ELECTRICITY
18th Edition
Revised by HAUSMANN

The new edition of this standard text has been entirely reset and brought up-to-date by Erich Hausmann, co-author of Hausmann and Slack's *Physics*. Outstanding features include the rearrangement of subject matter, introduction of modern terms and symbols, and new developments in television, loran, and radar.

Some Other 1948 Books and a Few from 1947

Television Simplified (2nd Edition) — Kiver
Handmade Jewelry — Wiener
Elementary Radio Servicing — Wellman
FM Simplified — Kiver
Essentials of Strength of Materials — Pisani
Mathematics of the Shops (2nd Ed.) McMackin & Shaver
The Potter's Craft — Binns
Leathercraft — Thompson
Woodworking — Van Tassel

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Van Nostrand
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(Continued from page 53A)

♦ THOMAS HAMPTON, on leave of absence from his position as director of Natchitoches Trade School and associate professor of industrial education at Northwestern State College of Louisiana, has enrolled at Cornell University for study leading to the Ph.D. degree. Mr. Hampton, a major in industrial education, has elected minors in the fields of personnel relations and secondary education. His proposed thesis will involve a survey of Louisiana to determine the need for technical institutes.

Mr. Hampton formerly served as director of Huey P. Long Trade School and later as assistant state supervisor of trade and industrial education in Louisiana. Mr. Hampton also served as secretary-treasurer of the Louisiana Vocational Association.

♦ H. O. BJERG, instructor of industrial arts at Arizona State College, Flagstaff, was honored at the recent annual convention of the American Vocational Association in Los Angeles and Santa Barbara, Calif. Mr. Bjerg, who is secretary-treasurer of the Flagstaff chapter of Epsilon Pi Tau, was awarded the fraternity's Laureate Citation for outstanding achievement in the industrial-vocation field.

Association News

A.V.A. CONVENTION REPORT

(*Continued from page 19A of the February, 1948, issue*)

Industrial Education

The program chairmen for this section were O. H. Day, director of vocational education, Department of Vocational Education, Kansas City, Mo.; and Samuel L. Fick, chief, Bureau of Trade and Industrial Education, State Department of Education, Sacramento, Calif.

The National Association of State Supervisors of Trade and Industrial Education held their first meeting on Sunday, December 14, at 7:30 p.m. Speakers on this occasion were R. W. Gregory, Assistant U. S. Commissioner for Vocational Education, U. S. Office of Education, Washington, D. C.; Walter H. Cooper, chief, Trade and Industrial Education, U. S. Office of Education, Washington, D. C.; and L. H. Dennis, executive secretary, American Vocational Association, Inc., Washington, D. C. Herman N. Miller, state supervisor, Trade and Industrial Education, State Board for Vocational Education, Olympia, Wash., led the discussion which followed.

The Monday morning meet was held in conjunction with the National Association of State Supervisors of Trade and Industrial Education. The report on "An Analysis of Functions Performed in Operating a Local Program of Industrial Education" was given by S. Lewis Land, director, Vocational Teacher Education, The Pennsylvania State College, State College, Pa. Arthur B. Wrigley, Trenton, N. J., reported on "The Development of Instructional Material," and Paul Lofgren, Berkeley, Calif., reported on "Defining the Scope of Trade Competency Examinations."

Walter H. Cooper then addressed the group.

The state supervisors at their Monday afternoon meeting heard committee reports from Arthur B. Wrigley and Edward M. Claude, Springfield, Ill., on "The Development of Instructional Materials," and "Trade and Industrial Student Organizations."

O. H. Beaty, Topeka, Kans., was the discussion leader.

The National Association of Industrial Teacher Trainers met on Sunday, December 14, at 7:30 p.m. The theme of this meeting was "Improving Teacher Training of Industrial Arts," and Lynne C. Monroe, Santa Barbara, Calif., acted as chairman.

The subjects discussed were "The Expectations of a Supervisor of Industrial Arts Teachers," and "Meeting the Needs of Teacher Training in Industrial Arts."

At the Monday afternoon meeting E. L. Williams, College Station, Tex., and H. H. London, Columbia, Mo., were cochairmen.

Committee reports on "In-Service Training of Industrial Teachers," "Evaluation of Industrial Schools and Programs," "Vocational Technical Training," and "Audio-Visual Education," were given by Gerald B. Leighbody, Buffalo, N. Y.; R. W. Howes, Hartford, Conn.; James R. D. Eddy, Austin, Tex.; and Melvin L. Barlow, Los Angeles, Calif.

C. L. Wetzel, St. Louis, Mo., was chairman at the supervisory training session on Tuesday morning.

The subjects presented were "Supervisory Training in Modern Industry," by Robert T. Wieser, Flint, Mich.; and "Attacking Training Problems" by James C. Dunbar, Los Angeles, Calif.

"Glimpses of Putting It Across" was put on by a team consisting of J. L. Stanfill, Los Angeles, Calif.; Gerald C. Chappell; Robert O. Candee, Los Angeles, Calif.; and A. S. Mussatti, Los Angeles, Calif.

A panel discussion on "Meeting Industries Training Needs" followed. The panel was led by Robert Gray, Pasadena, Calif., and consisted of Joseph R. Strobel, Columbus, Ohio; Phil D. Holle, Los Angeles, Calif.; George Ford, Pasadena, Calif.; and Clifford H. Marker, Los Angeles, Calif.

The general session of the industrial education division held on Tuesday afternoon was dedicated to "Industrial Education for the Air Age."

The "Viewpoint of the Airline Operator" was presented by John H. Furbay; and "The Viewpoint of the Manufacturers of Aircraft" was presented by Captain L. D. Webb, U.S.N.

Then W. O. Johnson, W. Earl Sams, and Joseph J. Schwarz held a panel discussion on air-age education.

Graphic Arts Education

This section held several very interesting sessions.

Allison Manners, Los Angeles, Calif., was the chairman of the meeting on Tuesday morning at which the educational preparation for the work of the composing room, letterpress pressroom, bindery, lithographic platemaking, and lithographic pressroom were discussed by H. R. Younginer, Los Angeles, Calif.; Bert Fellowes, San Luis Obispo, Calif.; Zed Benson, Los Angeles, Calif.; C. A. McMillian, Oakland, Calif.; Frank Hazenkan, Los Angeles, Calif.; Win Sherwood, Los Angeles, Calif.; Guy Martin, San Francisco, Calif.; Lon Ganglmeyer, San Francisco, Calif.; and C. A. Hicks, San Francisco, Calif.

Fred J. Hartman, educational director, National Graphic Arts Education Association, Washington, D. C., then spoke on "Graphic Arts Education in 1947-48."

Allison Manners was the chairman at the meeting held Thursday morning. The subjects discussed were "Sales Management and Sales Work," "Production Management and Plant Engineering," and "Executive Management." The speakers were Dale Megor, E. Burnham Dunton, James Weldon, Frank McCaffrey, Gene Barron, and Hartley E. Jackson. John A. Backus, member of board of directors, National Graphic Arts Education Association; and manager, American Type Founders Sales Corporation, Department of Education, Elizabeth, N. J., then spoke on "Graphic Arts Education Observations From the Field."

(*To be continued*)

♦ On November 8 and 9 a group of vocational administrators met in Syracuse and organized the Association of Trade and Technical Administrators of New York State. This group is composed of directors of vocational education, supervisors, and principals of industrial and technical high

(Continued on page 57A)

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(Continued from page 54A)

schools. The membership will be composed entirely of representatives from local communities and the following were elected to office: Edward H. Lang, president, principal, Smith Technical and Industrial High School, Syracuse, N. Y.; Horace B. Griffiths, vice-president, assistant superintendent of schools, Utica, N. Y.; Nelson J. Murbach, secretary, director of vocational education, Batavia, N. Y.; Ernest H. Colton, treasurer, principal, trade school, Rome, N. Y. *Executive Committee:* Francis H. Wing, assistant superintendent of schools, Buffalo; Harry T. Wilson, director of vocational education, Watertown; John B. Lillie, assistant superintendent of schools, Binghamton; William Pabst, principal, Brooklyn Technical High School; George F. Pigott, Jr., associate superintendent of schools, New York, N. Y.

The purpose of this organization is to maintain standards of teachers and instruction in vocational schools, to work through committees in studying and reporting on problems effecting these schools.

The organization is affiliated with the National Council of Local Supervisors of Vocational Education and plans to work in close co-operation with representatives of the State Education Department in the development of educational programs for the training of youth for industrial employment. — *Edward H. Lang.*

♦ The Associated Guilds of Teachers of Industrial Arts of the City of New York recently re-elected the entire slate of officers for the year 1948: president, John M. Hurley; vice-president, Fred Berrian; secretaries, Charles E. Denely and George Olsen; treasurer, Abraham Gendel.

♦ The thirty-fourth national convention of the American Association of Collegiate Registrars will be held in Philadelphia, Pa., on April 19 to 22, 1948. Carrie Mae Probst, registrar, Goucher College, Baltimore, Md., is president of the Assso-ciation, and Gustave E. Metz, registrar, Clemson Agricultural College, Clemson, S. C. is secretary.

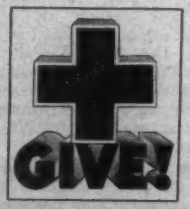
♦ The National Society for the Prevention of Blindness, 1790 Broadway, New York 19, N. Y., will hold a three-day conference April 5, 6, and 7, at the Hotel Radisson, Minneapolis, Minn. This conference will be of interest to persons who are directly or indirectly concerned with eye health and safety. Details concerning the program may be obtained by writing directly to the Society.

♦ The Cincinnati Vocational Guidance Association will hold the following meetings during 1948. All of them will be held at the Walnut Hills Branch Public Library, Kemper Lane and Locust St., Cincinnati, Ohio, at 8 p.m.

March 10, April 14, May 12. George W. Winter, 2982 Linwood Road, Cincinnati 8, Ohio, is the general chairman.

♦ The American National Red Cross, National Headquarters, Washington 13, D. C., will again make its March appeal for funds to fulfill its responsibilities.

During the first nine months of 1947 $7,700,000 from Red Cross funds went to aid disaster sufferers. The Texas City, Tex., catastrophe required more than $1,000,000 of these funds. In the September hurricane disaster an additional $1,000,000 was appropriated.



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News Notes

♦ Forty-five students from the Kansas State Teachers College printing department, accompanied by Professor Leroy Brewington, head of the printing department, John Gilbreath, and James Bertone, instructors, went to Tulsa, Okla., December 4 to 5, to make a tour of printing plants and industries there.

♦ Thirty-five Brazilians, who are spending three months in intensive teacher training at Colorado A. & M. College, arrived in Fort Collins, Colo., Saturday, February 7, and began classes the following Monday. Herb Heilig, director of vocational education at the College, is in charge of the visitors' instruction.

The visitors are selected instructors from trade schools throughout Brazil and are here under a hemisphere solidarity program supervised by the U. S. State Department through the Institute of Inter-American Affairs. Instruction received at Colorado A. & M. will form the basis for introducing formal teacher training in Brazil.

In the United States for a period of nine months, the Brazilians were scattered for training in various industries after visiting trade schools in the east at the outset of their visit. Early in February they regrouped in Chicago, left for Denver by train, and arrived in Fort Collins by bus.

Designated courses will be completed by May 6 in time for the visitors to return to Brazil by May 11. Some of these Colorado-instructed men will form the unit to begin instructing more than 200 Brazilian teachers in formal teacher training, it was explained.

♦ A steady increase in the number of apprentices in the skilled trades has brought the number of those currently registered to 183,000, an all-time record.

By registered apprentices are meant only those listed with a State Apprenticeship agency (or, where none exists, with the Federal Committee on Apprenticeship) and employed under apprenticeship programs approved by these bodies. The Federal Committee is the national management-labor advisory body for the Apprentice Training Service which gives technical assistance in setting up and maintaining apprenticeship programs.

All apprentices should be registered, because registration means that the apprentice is being trained under a bona-fide program which will enable him to become a real craftsman, and because registration figures give industry a reliable yardstick which will help it determine how many apprentices should be in training to maintain the required skilled work force.

♦ "Treasure From the Sea," a new 16mm. sound-reduction film, produced in technicolor, has been announced by the Princeton Film Center, Princeton, N. J. The film takes its title from the Dow-perfected process of manufacturing magnesium from a formula in which sea water is a component part. Brief but entertaining in the familiar Disney style, it illustrates the effect that the use of magnesium has on both the consumer and the industrial fields. It is available for showing in vocational and technical classes in schools and educational institutions.

♦ The number of establishments with registered apprenticeship programs in the skilled trades in the United States has increased by more than 164 per cent from September, 1945, to September, 1946, according to William F. Patterson, director of the apprentice-training service of the U. S. Department of Labor.

Speaking at a conference of the American Society of Training Directors at New Castle, Pa., Mr. Patterson declared the number of establishments with apprenticeship programs had increased from 25,000 in September, 1945, to 68,000 in September, 1946. He cited as reasons for the expansion (1) the demand for workers in the war years, (2) the lack of skilled workers in some trades today, and (3) the production program anticipated for which thousands of craftsmen will be needed.

During the past 12 months national apprenticeship standards have been established in four trades in the construction industry: bricklaying, plastering, cement finishing, and roofing. This brings to ten the number of trades in the construction industry for which national apprenticeship standards have been set up. The national standards are patterns for setting up local apprenticeship systems, and specify that an apprentice be given training in the skills of his trade, in related classroom instruction, that wages be paid, and that pertinent matters be covered by a written agreement.

♦ The subjects of food and nutrition are presented in two new teaching aids — a film-strip series and a slide set, both in natural color — now available from the Audio-Visual Division of Popular Science Publishing Company, 353 Fourth Avenue, New York. Both are for upper elementary and junior high school classes in health education, general science, domestic science, and home economics.

The film-strip series, entitled "Food and Nutrition," consists of five strips, each approximately 50 frames in length: The Essentials of Diet; Eat Well! Live Well!; The Nutrients in Food; How Food Is Digested; Consumer Problems in Nutrition. The slide set, also entitled "Food and Nutrition," consists of 50 kodachrome photographs and cartoons.

(Continued on page 60A)

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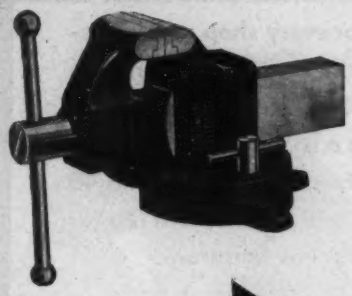

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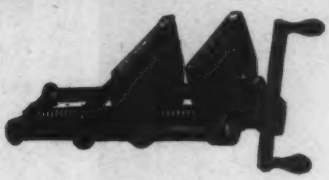

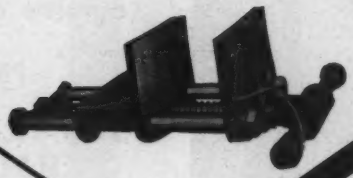

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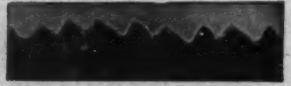

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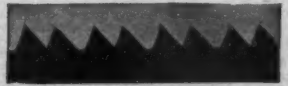

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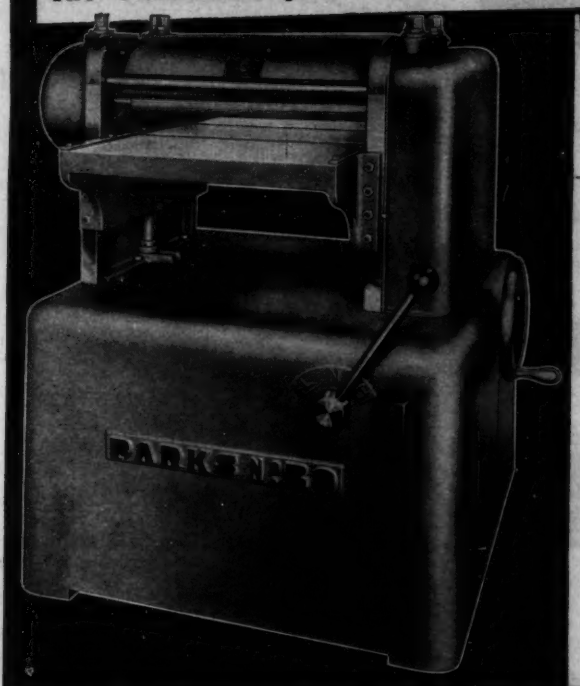

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(Continued from page 58A)

Both film strips and slides deal with selection of foods, food nutrients, essentials of diet, consumer problems, and other food aspects.

Functional teaching guides accompany the filmstrip series and the slide sets. For further information write to the address given in the foregoing.

♦ Studies of employment trends and opportunities in the various occupations and professions are made by the Occupational Outlook Service of the Bureau of Labor Statistics.

For the following Occupational Outlook Bulletins write to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Employment Opportunities for Diesel-Engine Mechanics, Bulletin No. 813 (1945), price, 5 cents.

Employment Opportunities in Aviation Occupations, Part II, "Duties, Qualifications, Earnings, and Working Conditions," Bulletin No. 837–2 (1946), price, 20 cents

Employment Outlook for Automobile Mechanics, Bulletin No. 842 (1945), price, 10 cents.

Employment Opportunities for Welders, Bulletin No. 844 (1945), price, 10 cents.

Employment Opportunities in Foundry Occupations, Bulletin No. 880 (1946), price, 15 cents.

Postwar Employment Prospects for Women in the Hosiery Industry, Bulletin No. 835 (1945), price, 5 cents.

♦ New England Textile Foundation, 68 South Main St., Providence 3, R. I., announces that it will award up to thirty $500 freshman scholarships in 1948 in the textile schools of New England: Bradford Durfee Technical Institute, Fall River, Mass.; Lowell Textile Institute, Lowell, Mass.; New Bedford Textile Institute, New Bedford, Mass.; and Textile School of Rhode Island School of Design, Providence, R. I.

Scholarships will be awarded on the basis of the student's high school record, as reported by the principal, and marks obtained in an examination given by College Entrance Examination Board on April 3, 1948, in various parts of the country.

Seniors in high school or graduates of high school not over 21 years of age who wish to compete should write direct to the Foundation for application blanks and scholarship booklet.

♦ Vocational counselors, and anyone who wants to make a living from his interest in traveling, will find helpful information in a new six-page leaflet on employment in travel bureaus. The title is Occupational Abstract No. 94 on *Travel Bureaus*. It covers the nature of the work, qualifications and preparation required, methods of entrance and advancement, postwar employment trends, and sources of further information. The price is 25 cents. Occupational Index, Inc., New York University, New York 3, N. Y.

New Publications

Mechanical Drafting Essentials

By Walter E. Farnham and Francis T. McCabe. Paper, spiral binding, 196 pp., 9 by 11⅓ in., illus., $2.75. Prentice-Hall, Inc., New York, N. Y.

A text presenting a combination text and workbook on blueprint reading, technical sketching, and mechanical drafting.

Much of the work can be done on the cross-sectioned pages which are interspersed throughout the book.

The book is divided into brief units, each of which is arranged to provide a tryout, actual work, and a text.

Course in Auto Mechanics
(Power Transmission and Engine Cooling—Second Year)

Prepared under the direction of Miles H. Anderson, assistant state supervisor of veterans' apprenticeship classes, by Cecil A. Potter, teacher of auto mechanics, Pasadena Junior College. Published by the Instructional Materials Laboratory, Bureau of Trade and Industrial Education, Department of Education, Sacramento, Calif. Paper cover, 81 pp., 8½ by 11 in. Tests to Accompany, 90 pp., 8½ by 11 in.

This is a workbook for apprentices in auto mechanics specially written for veterans of World War II who want to learn to be auto mechanics.

It divides the subject into seven units in which the friction clutch, fluid drive, transmission, universal joints and car drives, rear axles, and the cooling system are explained.

There is also a chapter on the ethics of a business organization.

A separate book of tests to accompany the workbook also has been prepared.

Occupational Briefs

No. 224. *Industrial Health Personnel*
No. 225. *Geographers*
No. 226. *Circus Workers*
No. 227. *Gift and Art Shop Managers*
No. 228. *Traffic Management Workers*
No. 229. *Butchers*

Published by Science Research Associates, 228 S. Wabash Ave., Chicago 4, Ill. Each contains four 8½ by 11-in. pp., 15 cents each.

Each occupational analyses presents a brief description of the occupation for which it was prepared and then describes the jobs, the requirements for entry, the methods of entering, opportunities, and related occupations, advancement opportunities, earnings, advantages and disadvantages, and the future of the occupation.

Plastics Dictionary

By Thomas A. Dickinson. Cloth, 312 pp., 6 by 9¼ in., illus., $5. Pitman Publishing Corp., New York City.

A book in which are defined the common terms used by those who are engaged in the plastics

(Continued on page 62A)

ATKINS

Picture of a Good Start

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HARDWARE · HAND TOOLS · ELECTRIC TOOLS

Print-Shop Equipment

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BELLOWS
- a) Hand, small size
- b) Electric, blower type

BLACKBOARD — permanent or portable

BOOKCASE — for reference books, catalogs, etc., sectional preferable

BRAYER — 6 or 8 in. for proofing

BRUSHES
- a) Bench
- b) Benzine, No. 1, oval black
- c) Floor
- d) Padding, 1½ in. wide

BULLETIN BOARD

CABINETS
- a) Galley, for double column, wood or steel, four tiers (to be used with typesetting machines)
- b) Galley, for 8¾ in. by 13 in. galleys, wood or steel, four tiers
- c) Ink and roller, to accommodate platen-press rollers, wood or steel
- d) Matrix, for use with typesetting machines only
- e) Roller, cabinet or rack for cylinder rollers
- f) Supply, for leads, slugs, spaces, strip material, with top for lead cutter and mitering machine
- g) Type, school type, each to accommodate two California cases, job cases, case slides, galley slide, and copyholder
- h) Type, complete with 24 full-size California job cases, with overhead lead-and-slug cases, wood
- i) Type, complete with 24 full size California job cases double work band, wood or steel
- k) Wood or metal, for filing class records, instruction sheets, etc.
- l) Storage for cuts

CANS
- a) Benzine, pint size
- b) Benzine, 5-gal. size
- c) Kerosene, safety, 1-gal. size
- d) Waste can, fireproof, for rags

CASES
- a) Blank, full-size, to accommodate ¼-size cases
- b) Border, ¼ size, for ornamental borders
- c) Lead and slug, regular size, to hold laborsaving fonts of leads and slugs
- d) Metal furniture, to hold laborsaving fonts
- e) Rule, ¼ size, for brass rule

CHAIRS — teacher's and tablet arm

CHASE RACKS
- a) For platen presses
- b) For cylinder presses

CHASES
- a) For each size of platen press
- b) For cylinder press

COMPOSING STICKS — 6 by 2 in., 8 by 2 in., 12 by 2 in., and 18 by 2 in., adjustable

CUTTER
- a) Lead and rule
- b) Paper, lever type, 20 in., with pedestal. Should handle 20 by 26-in. sheet
- c) Paper, lever type, 26 in. or 30 in.
- d) Paper, lever type, 30 in., with divided back gauge
- e) 30 in. to 36 in. power cutter

DESK
- a) Bindery, 80 by 36 in.
- b) Drying rack
- c) Imposing, 51 by 39
- d) Make-ready, 32 by 24 in.
- e) Paper cutters, 80 by 36 in.
- f) Proofreaders
- g) Teachers

DRYING RACKS
- a) Combination drying rack and stock table for platen presses, 30 trays
- b) Trays, interlocking, for cylinder press

FOLDING BONES — for hand folding

FOLDING MACHINE — 20 by 26-in. size, 4 fold, two parallel and two right-angle folds, power

FURNITURE — iron, 2 by 4 to 10 by 15 picas

GALLEYS — Steel, 8¾ by 13 in., 6¼ by 23½ in., double column, and 12 by 18 in.

GAUGE PINS — spring tongue

GLUE POT — electric, 1-qt. size

IMPOSING TABLES
- a) 12 by 18 in., with iron top, including reglets and furniture
- b) 24 by 36 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- c) 36 by 48 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- d) 39 by 63 in., with iron top, complete drawers, letter boards, reglets, and furniture

INK FOUNTAINS
- a) Short, for 8 by 12, 10 by 15, and 12 by 18 presses
- b) Long, for 10 by 15, and 12 by 18 presses

KNIVES
- a) Overlay, for make ready
- b) Ink, 6 in. and 8 in.
- c) Ink, 8 in., square end

LEADER BOXES

LEADERS
- a) 6, 8, and 10 pt., fine dot
- b) 8 and 10 pt., hyphen

LINE GAUGES
- a) Metal, brass, or steel
- b) Wood

MALLET

METAL FURNACE — for recasting and refining type metal, used only with typesetting machines

MITERING MACHINE

NUMBERING MACHINES
- a) For use on presses
- b) Hand machines

ORNAMENTS
- a) Assorted floral and decorative designs
- b) Border, 6 and 12 pt., decorative

PAPER-DRILLING MACHINE

PERFORATOR
- a) 24 in., foot treadle
- b) 28 in., foot treadle

PLANER
- a) Mallets, hickory or fiber
- b) Proof, maple, with felt bottom
- c) Type, maple, with leather top

PRESSES
- a) Cylinder, two revolution, four roller, 17 by 22, complete with variable-speed motor, cast rollers, etc.
- b) Platen, 8 by 12, with foot treadle, counter, flywheel guard, platen guard, brake, and set of cast rollers (motor and treadle combination if desired)
- c) Platen, 10 by 15, complete with variable-speed motor, counter, flywheel guard, brake, and set of cast rollers, etc.
- d) Platen, 12 by 18, complete with variable-speed motors, counter, flywheel guard, platen guard, brake, and set of cast rollers, etc.
- e) Proof, 14 by 18, with cabinet
- f) Proof, 20 by 24, with cabinet
- g) Proof, 23 by 24½ with cabinet
- h) Tableting

PUNCH
- a) Foot power, multiple with assorted punches
- b) Lever, two die, with assorted punches
- c) Power, multiple, with assorted punches (paper drill may be substituted)

QUOINS
- a) Sizes No. 1 and No. 2
- b) Keys, Sizes No. 1 and No. 2

RULE — plain and brass (fonts to fit quarter cases)
- a) 2 pt., laborsaving, hair line, side face
- b) 2 pt., laborsaving, 1 pt. side face
- c) 1 pt., laborsaving, 1 pt. face
- d) 2 pt., laborsaving, double face

SAW TRIMMERS — pedestal type, with point gauge, and raising and lowering table

SILK-SCREEN UNIT

SPACING MATERIAL
- a) Iron furniture, as selected
- b) Leads, laborsaving, 2 pt.
- c) Leads, 2-ft. strips, 2 pt.
- d) Slugs, laborsaving, 6 pt.
- e) Slugs, 2-ft. strips, 6 pt.
- f) Spaces and quads
- g) Thin spaces, brass and copper, assorted sizes, 6 to 8 pt., one size in each box

SPECIMEN DISPLAY BOARD

STAPLE BINDER — pedestal type, foot power

STEREOTYPING UNIT, 8 by 12 in.

STITCHER — wire, power, capacity ½ in. or ¾ in., flat- and saddle-back tables

TWEEZERS — 3½ in.

TYMPAN PAPER (with combination holder and cutter)
- a) 18 in.
- b) 38 in., upright, to be used with cylinder press only

TYPE
- a) Body, lightface — 8 and 10 pt.
- b) Job, lightface — 6, 8, 10, 12, 14, 18, 24, 30, 36, and 48 pt.
- c) Job, lightface italics — 8, 10, 12, 14, 18, 24, and 36 pt.
- d) Job, boldface — 6 and 8 pt.; 12 pt., No. 26; 12 pt., No. 27; 12 pt., No. 28; 18 pt., No. 30
- e) Job, light copperplate Gothic — 6 pt., Nos. 1, 2, 3, 4; 12 pt., Nos. 5, 6, 7, 8
- f) Job, condensed title Gothic — 12, 18, 24, 36, 48, 60, and 72 pt.
- g) Job, text type — 10, 12, 14, 18, and 24 pt.
- h) Job, typewriter type — 12 pt. with spaces
- i) Job, boldface italic — 8, 10, 12, 14, 18, 24, 30, and 36 pt.
- k) Job, heavy copperplate Gothic

(Continued on page 64A)

(Continued from page 60A)

industry. It will be found helpful by the student as well as by those working in industrial plants where plastics are produced or used in fabricating products consisting partly or wholly of plastic materials.

Terms used in the British plastic industry also are included, as well as tables on catalysts, chemical elements, fillers, pigments, plasticizers, solvents, and the like.

Food Products

By Saul Blumenthal. Cloth, 986 pp., 6 by 8⅞ in., $12. Chemical Publishing Co., Inc., Brooklyn, N. Y.

A book which contains the practical experience of a number of food manufacturers. It is very complete and contains numerous formulas and directions for processing many kinds of food products.

The 15 chapters discuss the basic food ingredients; milk and milk products; confectionary and beverages; dessert powders and puddings; sauces, dressings, and pickles; fish; fried and health food; pie fillings and pies; cookies, doughnuts, and cakes; flavors and syrups; fruits and vegetables; canned goods, jellies and preserves; and preserving by dehydration and freezing. There also is a chapter on plant sanitation, and one on composition of foods and prevention of caking.

Weaving You Can Do

By Edith Louise Allen. Cloth, 118 pp., 5⅜ by 7⅞ in., illus., $2.50. The Manual Arts Press, Peoria 3, Ill.

An excellent text describing weaving from the simple beginning on a weaving frame to work carried on with table or floor looms.

Design and draft reading also is explained and a number of pattern problems are discussed.

Standard Welding Symbols

Prepared by the A.W.S. Committee on Symbols. Paper cover, 69 pp., 6 by 9 in. American Welding Society, 33 West 39th St., New York 18, N. Y.

The 1947 standards carefully consider the new welding processes that have been developed, and present rules which provide for all the needs of management, the designer, and the shopman.

The 1947 Standards present a step-by-step presentation in lecture-type form. The rules have been expanded to include a means of indicating welds having root penetration. Other features are

(Continued on page 63A)

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(Continued from page 62A)

the dropping of the confusing terms "near side" and "far side," from the nomenclature, the addition of 45 illustrations showing the various application of the symbols, and a chart which provides a compact summary of the use of the welding symbols for ready reference.

Aircraft Sheet Metal

By Col. R. H. Drake. Cloth, 233 pp., 6⅜ by 9½ in., illus., $5.50. The Macmillan Co., New York, N. Y.

A book designed to help those who aim to obtain an aircraft mechanic's license.

The material is presented in terms that are readily understood, and they cover the sheet metals, aluminum, magnesium, iron, and their various alloys, giving their compositions and properties, and directions for their identification.

Directions for reading engineering drawings also are given, and the methods of heat-treating, laying out, hand and machine forming, are explained by word and illustration.

The chapter on general safety practices is good, and the glossary should be helpful to the beginner.

Educators Guide to Free Films

Compiled and edited by Mary Foley and John W. Diffor. Paper, 341 pp., 8¼ by 10¾ in., $5. Educators Progress Service, Randolph, Wis.

An organized list of up-to-date free educational, informational, and entertainment films.

The material is arranged so that films on a wide variety of subjects can be found conveniently and quickly.

Raw Materials from the Sea

By E. Frankland Armstrong and L. Mackenzie Miall. Cloth, 164 pp., 5½ by 8¼ in., illus., $3.75. Chemical Publishing Co., Brooklyn 2, N. Y.

A book in which the chemicals, and biochemistry of the water in rivers, lakes, seas, and oceans are discussed. Also the methods by which the various ingredients can be taken out of the water and put to use in industry.

The book is written in an interesting and understandable way, although the subject matter is quite technical.

Production, Marketing, and Financial Management Series

Published by the American Management Association, 330 West 42 St., New York 18, N. Y.

A valuable series of booklets which should be of great interest to all teachers of industrial arts and vocational education. All of the titles in the following list have a uniform 6 by 9-in. size.

Marketing Series: No. 65. Aids in Training and Selecting Salesmen, 40 pp., 75 cents; No. 66. Principles and Practices in Sales Compensation, 27 pp., 50 cents.

Financial Management Series: No. 88. Reporting to Employees and the Public on Profits and Productivity, 43 pp., $1.

Production Series: No. 163. Management Techniques for Increasing Labor Productivity, 51 pp., 75 cents; No. 164. Quality and Expense Control, 24 pp., 50 cents; No. 165. Getting and Using Employees' Ideas, 31 pp., 50 cents; No. 166. The Foreman — The Job and the Man, 31 pp., 50 cents; No. 167. Human Relations Opportunities for Management, 33 pp., 50 cents; No. 169. Production Policies for Increased Output, 35 pp., 75 cents; No. 170. The Human Aspects of Methods Improvement, 50 pp., $1.

Hammered Silver Flatware

By Rudy Renzius. Paper, 16 pp., 4¾ by 6⅞ in., illus.

An interesting little booklet explaining how to make spoons, ladles, nut scoops, and sugar and ice tongs. The booklet is one of the Craftsmen's Library, edited by Dr. Ivan H. Crowell, director of handicrafts, Department of Industry and Reconstruction, Fredericton, N.B., Canada.

Diploma Engrossing

By Ralph A. Loomis. Paper cover, 64 pp., 6¼ by 9¾ in., illus., $1.25. The Manual Arts Press, Peoria, Ill.

A brief, lucid explanation on the art of engrossing. The book not only lists the equipment that is needed, but also shows how that equipment can be made, and how the pens that are used can be kept in good workable condition.

The author's suggestions for learning the basic strokes and for finishing the letters are very good, and anyone who will faithfully follow them will eventually turn out acceptable work.

Engineering Science and Management War Training —Final Report

By Henry H. Armsby. Paper, 149 pp., 5⅞ by 9⅛ in., 35 cents. Published by Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

The Veteran and Higher Education

A report to the President by the Director of War Mobilization and Reconversion, Government Printing Office, Washington 25, D. C.

Industrial Films — A Source of Occupational Information

U. S. Department of Labor, United States Employment Service, Washington 25, D. C.

Safety Education in Industrial Arts Departments

Industrial Arts Bulletin No. 4. Department of Education, Jefferson City, Mo.

Building Your Marriage

By Evelyn Millis Duvall. Public Affairs Pamphlet No. 113. 32 pp., 5⅜ by 8⅛ in., illus., 10 cents. Public Affairs Committee, Inc., 30 Rockefeller Plaza, New York 20, N. Y.

Our Negro Veterans

By Charles G. Bolté and Louis Harris. Public Affairs Pamphlet No. 128. 32 pp., 5⅜ by 8⅛ in., illus. Price, 10 cents. Public Affairs Committee, Inc., 30 Rockefeller Plaza, New York 20, N. Y.

Temporary Employment for Veterans

Goodwin Publications, 1778 Fairmount Ave., Cincinnati, Ohio. Price, 50 cents.

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(Continued from page 62A)

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o) 10 pt. fractions
p) 10 pt. references
q) Parentheses and brackets
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s) 6 pt. laborsaving slugs, 4 to 25 picas
t) 2 pt. laborsaving brass rule
u) 2 pt. miters for rule
v) Laborsaving metal furniture
w) Thin spaces with quarter-size case

TYPESETTING MACHINES
a) Either linotype or intertype, 2 or 3 magazines, and molds
b) Matrices for same, 6, 8, 10, and 12 point, as selected

VISUAL AID CHARTS

Print-Shop Supplies

BENZINE OR GASOLINE — for cleaning type or presses

BINDERY TAPE — 2 in. wide, brown or black

GOLD BRONZE — pale

INK
a) Bond, black, for bond papers
b) Book, black, for school papers, etc.
c) Cover, colors as selected
d) Dryers and compounds, as selected
e) Half tone, black
f) Job, colors as selected
g) Metallic, gold and silver
h) Process, black, red, yellow, blue

KEROSINE — for cleaning rollers

PADDING CEMENT
a) Cold
b) Hot

PAPER
a) Bond, fine grade, 17 by 22 — 20, white
b) Bond, medium grade, 17 by 22 — 20, white
c) Bond, sulphite, 17 by 22 — 20, white
d) Bond, sulphite, 17 by 22 — 20, colors as selected
e) Book, enamel, 25 by 38 — 80, white
f) Book, machine finish, 25 by 38 — 80, white
g) Book, eggshell finish, 25 by 38 — 60, white
h) Cover, as selected, 20 by 26, medium
i) Card Bristol, fine grade, 22 by 28 — 4 ply, white
j) Index Bristol, medium grade, 25½ by 30½ — 110, white
k) Index Bristol, medium grade, 25½ by 30½ — 140, white
m) Mill Bristol, medium grade, 25½ by 30½ — 140, colors as selected
n) Pressboard, red
o) Strawboard, No. 40 or No. 50
p) Tagboard, manila, 24 by 36 — 140
q) Tympan, to fit presses
r) Wrapping paper, size as selected
s) Holder for same

PASTE
a) Bindery
b) Make ready

SILK-SCREEN SUPPLIES consisting of:
a) Silk-screen process paste paint, 1 each of the following colors: toluidine red, strontian yellow, ultramarine blue, medium green, rich brown, orange, purple, white, and black
b) Solvent profilm in 11- by 14-in. sheets
c) 8-in. synthetic squeegee
d) 11-in. synthetic squeegee
e) No-clog varnish
f) Film solvent
g) Stencil filler
h) Filler remover
i) Stencil knife
k) Fiber guides
l) Red sable brush — ½ in.
m) Putty knife
n) Frame tape

TWINE — cotton, for tying jobs

WIRE STITCHING
a) No. 28 round wire for stitcher
b) Wire staples, ¼ in.

Drafting Equipment and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

ADJUSTABLE-CURVE RULER

BEAM COMPASS

BENCH BRUSHES

BLACKBOARD
a) Permanent or portable

BLUEPRINT
a) Frame or machine
b) Washing trays or washer
c) Paper tube, airtight
d) Drying rack or dryer

BOOKCASE

CABINET
a) For filing drawings
b) Compass, 15 in., with locking device
c) Drawing set: T square, straightedge, triangle, and protractor

(Continued on page 66A)

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CRAFT BOOKS

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A "how to do it" book of instruction for the craftsman who works with plastics. Brief step-by-step descriptions with pictures tell how to work plastics with hand tools and home workshop power tools. Forty-nine projects. Revised 1947 Edition

GENERAL LEATHERCRAFT
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This valuable book on leathercraft presents 35 attractive projects with easy step-by-step illustrated instructions. Tells "how" to tan, glue, tool, etc., makes it especially easy for beginners to quickly make useful articles. Revised 1946 Edition

GENERAL BOOKBINDING
By Chris H. Groneman — $1.00

Elementary instruction in hand bookbinding — for individual and classroom use. Presented in the form of attractive projects. Clear directions and many illustrations. This book tells "how" to make the necessary equipment for bookbinding — enabling the school or individual to set up the equipment at small expense. Revised 1946 Edition

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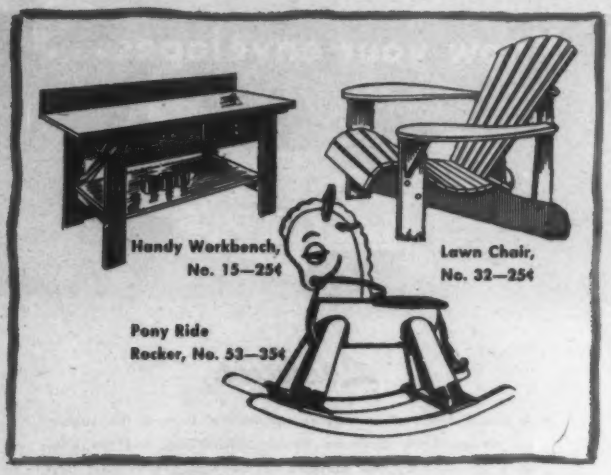

EASI-BILD* Full-Size Patterns speed manual training 2 ways:

1. **Easi-Bild** makes project selection easier. Folder illustrates over 100 *useful, practical* projects.
2. **Gives student** self confidence because he makes something *quick* and *right* the first time. No blueprint training required.

Plus: the experience in using these famous CASCO industry-tested glues recommended by Easi-Bild.

Cascophen for outdoor projects—boats, sports equipment.

Cascamite for indoor projects—furniture, toys, cabinets.

Cascorez for models, paper projects or where "fast set" is important.

See for yourself. Send coupon below for any of the 3 popular patterns shown above... also description of complete pattern service. See how Easi-Bild *simplifies* woodworking.

CASCO Pattern Dept. IV-38, P. O. Box 215, Pleasantville, N. Y.
Enclosed is_____ for patterns checked below.

☐ Lawn Chair, No. 32—25¢ ... ☐ Pony Ride Rocker, No. 53—35¢ ... ☐ Handy Workbench, No. 15—25¢

Name_____ Title_____

School_____

Address_____

City_____ Zone_____ State_____

CASEIN COMPANY OF AMERICA

Division of The Borden Company

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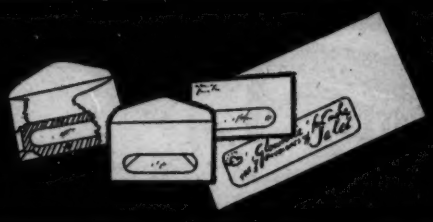
Know your envelopes . . .



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A modification of a regular commercial style is the Lookin . . . designed to eliminate double addressing and the possibility of inserting the contents in the wrong envelope. The "cut out" is covered by translucent glassine or a transparent substance. Western's transparent Lookins are known as 'Plasticleer' Lookins. The use of Plasticleer, in addition to making the address perfectly legible, has opened up another avenue of clever advertising. Pertinent messages can be imprinted inexpensively on the inside of your envelope and when the enclosure is removed, your message is effectively and attractively displayed before your customer. This unusual and economical method of augmenting your advertising is well worth considering on your next order of Lookin envelopes.

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Lead and Rule Cutters and Mitering Machines are of vital importance. They should be checked frequently and repaired or replaced if there is a QUESTION of accuracy.

New ROUSE tools will often solve the problem of work-ups, bad corners, and springy forms. Completely equip your composing room with ROUSE tools, NOW.

SEE YOUR NEAREST DEALER, OR WRITE FOR CIRCULAR TODAY.

H. B ROUSE & CO.

(Continued from page 64A)

b) For storing drawing boards
c) For storing drawing instruments
d) For storing models

CALIPERS — 6 in. and 8 in., inside and outside
CHAIR — teacher's
DESK — teacher's
DIVIDERS — proportional
DRAFTING MACHINE — and accessories
DRAFTSMAN'S STEEL PROTRACTOR
DRAWING BOARDS — large
DRAWING-BOARD SUPPORTS — to be set on or attached to woodworker's bench
DRAWING TABLES AND STOOLS
a) For students
b) For teachers
INK-BOTTLE HOLDER
IRREGULAR CURVES — Nos. 17, 21, and 24, wood, rubber, or transparent
LETTERING ANGLES
LETTERING PENS — assortment of 12
LEVEL OR TRANSIT — builders' for architectural students
LEVELING ROD — for use with the transit
MACHINISTS' COMBINATION SET — 12 in.
MARKING PINS — for use with measuring tape, for architectural students
MICROMETER — 1 in., for mechanical-drafting students
OILSTONE — 3-in. case
PANTOGRAPH — 21 in.
PARALLEL RULES
PLANIMETERS
PLUMB BOB
SHEARS — for trimming blueprints and drawings
SPEED COUNTER — for mechanical-drafting students
STEEL SCALES — 12 in.
STOP WATCH — for mechanical-drafting students
TABLE
a) For cutting and trimming drawings and blueprints
b) For disassembling and reassembling machine parts and models
TAPELINE
a) 100 ft., steel, for architectural students
b) 50 ft., steel or metallic
TOOLBOX — containing 1 machinists' hammer, one 6-in. adjustable wrench, one 6-in. screw driver, one 6-in. combination pliers
TRIANGLES
a) 30-60 deg., 14 in. transparent
b) 45 deg., 10 in. transparent
TRIANGULAR SCALES — civil engineers' type, 12 in.
T SQUARE — adjustable or fixed head, for large drawing board or straightedge with parallel rule attachment for large drawing boards
WALL CHARTS — lettering, decimal equivalents, etc.
YARDSTICK
To be provided by, or for, each student

Drafting—Small Equipment

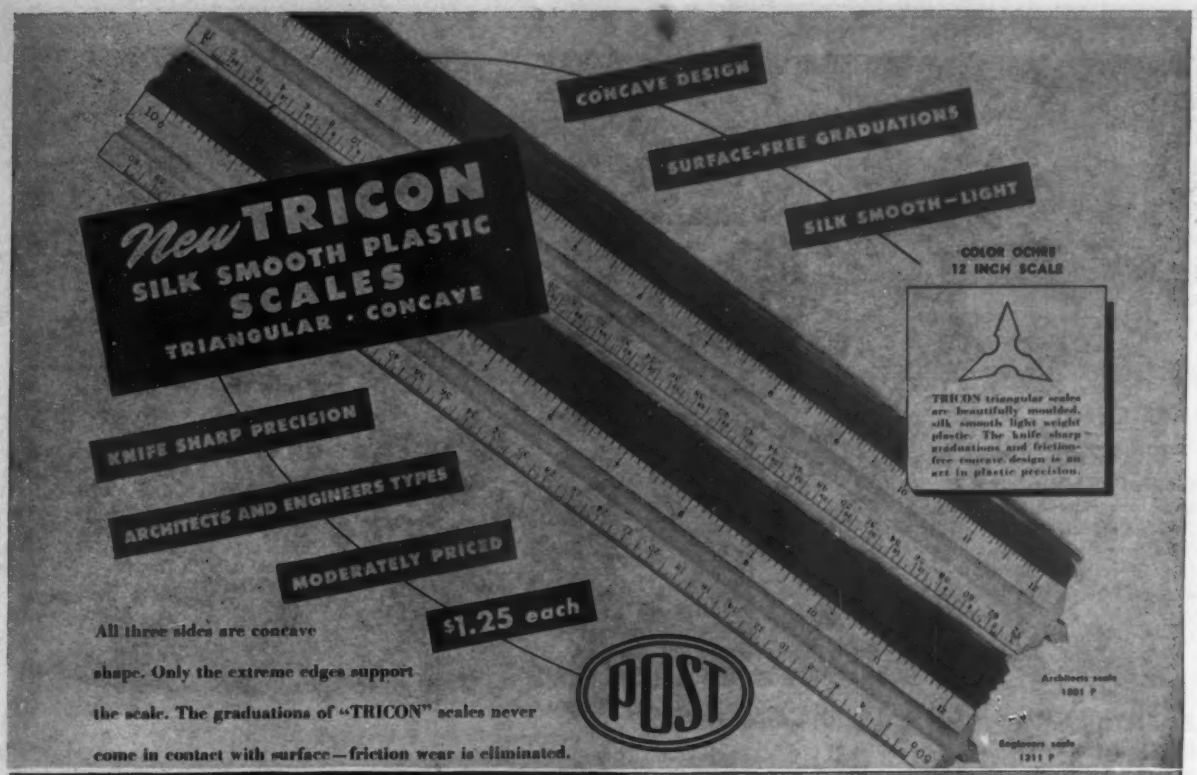
DRAWING BOARD — size to be specified by instructor
DRAWING INSTRUMENTS — as specified by instructor
ERASING SHIELD
IRREGULAR CURVE — Nos. 8 and 13, transparent
PENCIL COMPASS
PENHOLDER — for lettering pens
PENS — assorted, for lettering
PROTRACTOR — not over 5 in.
SCALE — 12 in. architects', triangular
SCALE GUARD
SLIDE RULE — 10 in., as specified by instructor
T SQUARE — to fit drawing board
TRIANGLES — 30-60 deg., 10 in. transparent, and 45 deg., 8 in. transparent

Drafting Supplies

BICHROMATE OF POTASH — crystals
BLUEPRINT
a) Paper, 36 in. wide
b) Writing fluid
PAPER
a) Cross section, 8½ by 11 in.
b) Detail, 24 by 36 in.
c) Drawing, 24 by 36 in.
d) Isometric, 7 by 10 in.
e) Tracing, 36 in.
POWDER — for tracing cloth
TRACING CLOTH — 36 in.
VAN DYKE
a) Fixing salts
b) Paper, 36 in.
c) Writing fluid

Drafting—Additional Supplies

To be provided by, or for, each student
ERASERS
a) Cleaning
b) Ink
c) Pencil
INK
a) Black, waterproof
b) Colored, if required
PENCILS — DRAWING, HB, 2H, 3H, 4H, and 6H
PENCIL POINTER PAD
THUMBTACKS OR SCOTCH TAPE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TRIANGULAR • CONCAVE
CONCAVE DESIGN
SURFACE-FREE GRADUATIONS
SILK SMOOTH—LIGHT
COLOR OCHRE
12 INCH SCALE
TRICON triangular scales are beautifully moulded, silk smooth light weight plastic. The knife sharp graduations and friction-free concave design is an art in plastic precision.
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All three sides are concave shape. Only the extreme edges support the scale. The graduations of "TRICON" scales never come in contact with surface—friction wear is eliminated.
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Coordinated facts, standards of good operating practice written by an operator in operators' language.
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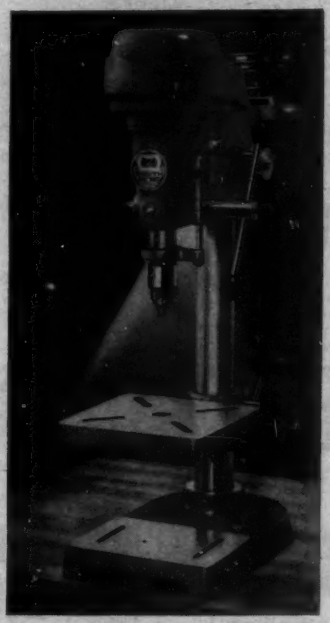
Shop Equipment News
NEW PRODUCTS — PUBLICATIONS

NEW PRECISION DRILL PRESS

A new 14-in. precision drill press has been announced by the South Bend Lathe Works, at South Bend, Ind. Both bench and floor models are now in production. Most specifications are common to both models, each having a capacity to drill ½ in. in iron or steel at the center of a 14-in. circle. Rugged construction assures lasting precision and durability.



South Bend 14-in. drill press

This drill press is equipped with a built-in light with independent switch to provide shielded illumination for the work area. A quick-acting belt tension release lever simplifies changing the spindle speeds and returns the vertical mounted motor to its original position after each change, thus maintaining the same belt tension for each of the four cone pulley steps.

The spindle has a maximum travel of 4 in., with spindle speeds of 707, 1305, 2345, and 4322 r.p.m. The depth gauge is graduated in sixteenths of an inch, and has adjustable collars to control both the depth of feed and the length of the return stroke.

A full tilt type table, with 10 by 10-in. precision ground top surface, has slots for clamping fixtures or work. The table can be locked quickly and securely in any position on the 2¾-in. diameter column.

The bench model drill press has 10⅞-in. maximum chuck to table distance, 10⅜-in. table travel, 17-in. maximum chuck to base distance, 10¾ by 17¾-in. slotted base with precision ground top surface, and 35½-in. over-all height.

The floor model drill press has 40⅛-in. maximum chuck to table distance, 40⅛-in. table travel, 46½-in. maximum chuck to base distance, 15 by 21-in. slotted base with precision ground top surface, and 65½-in. over-all height.

The drill press is supplied with or without motor, as desired. A 1/3-h.p., 1725-r.p.m. vertical mounting type motor is recommended. An on-off switch, motor line connection cord, V belt, motor pulley, and 0 to ½-in. capacity chucks are standard equipment.

Additional information can be obtained from the South Bend Lathe Works, 178 East Madison St., South Bend 22, Ind.

For brief reference use IAVE—0301.

NEW STANLEY ¼-IN. ELECTRIC DRILL

A new compact, sturdy, lightweight, small-size portable drill, No. 24, ¼-in. capacity, has been added to the line of Stanley Electric Tools. New Britain, Conn. It is suitable for drilling in metal, wood, and composition materials up to its rated capacity. Only 8½-in. overall, and weighing only 3¼ lb., it makes a handy drill for working in close quarters, and ideal for servicemen to carry in their tool kits for installation work and on-the-job repairs.

Stanley ¼-in. electric drill

Features of the No. 24 Stanley Drill include a strong aluminum die-cast housing, sturdy and durable gears, trigger type switch with locking device, three-jaw geared threaded Jacobs Chuck, positive cord clamp, three-wire, rubber covered cord with spring protector.

The No. 24 drill can be easily converted into a bench drill press by locking the drill in a No. 514 stand, which is obtainable from Stanley Electric Tools, New Britain, Conn.

For brief reference use IAVE—0302.

THE NEW HANDEE ERASER

The electrically driven hand eraser, shown herewith, makes smooth, clean erasures without smudge on tracings and drawings in a matter of seconds. The new eraser is balanced and shaped to fit the hand, and its weight is but 12 ounces. The same reliable motor as employed in the manufacture of Handee, tool of 1001 uses, is utilized to power the new Handee eraser. All

(Continued on page 70A)

The Handee Eraser

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THE WORLD FAMOUS

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July 6—August 14

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Related Courses in Industrial and Labor Relations, Guidance and Personnel, Administration and Supervision

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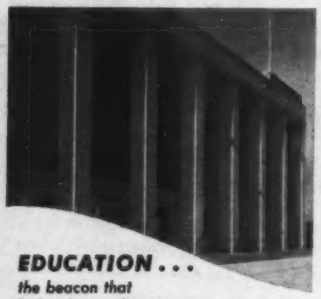
FOR SUMMER SESSION ANNOUNCEMENT WRITE TO:

DIRECTOR OF THE SUMMER SESSION
CORNELL UNIVERSITY
Ithaca, New York



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the beacon that lights the road to tomorrow

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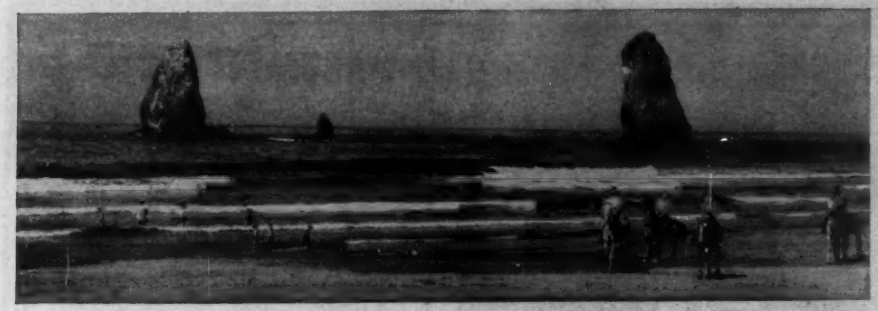
FOUR-YEAR CURRICULUM — B.S. DEGREE
MASTER'S DEGREE — PLANS A-B-X-Y
INDIVIDUAL PLANS FOR PH. D. DEGREE INDUSTRIAL ARTS AND SMITH-HUGHES, GEORGE-BARDEN COURSES
EXCELLENT LIBRARY FACILITIES.
UNEXCELLED RECREATIONAL PROGRAM
WIDE RANGE OF MANIPULATIVE COURSES
NEW SHOP AND OFFICE FACILITIES

Correspondence concerning undergraduate work and graduate patterns may be addressed to the Department of Industrial Education, 103 Temporary, near University High School.

The Dean of the Graduate School, 234 Administration Building, will supply a Bulletin of General Announcement and a blank of "Application for Admission".

Bulletins of Summer Session may be obtained from the Dean of the Summer Session, 853 Administration Bldg.

UNIVERSITY of MINNESOTA
MINNEAPOLIS 14, MINNESOTA



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Formal study in scenic surroundings, with the Pacific beaches two hours away and with week-end trips to the Cascade Mountains, Crater Lake, Oregon Caves, Cascade Lava Beds, and the Columbia River Highway.

GRADUATE AND UNDERGRADUATE work in Industrial Arts Teacher Education at a widely recognized school in splendid physical plant and with a strong staff of resident and guest professors.

Courses include: Drafting, Freehand Drawing and Design; Elementary and Advanced Woodwork; Wood Turning; Carpentry and Building Construction; Wood and Metal Finishing; Fiber Furniture Weaving; Recreational Handcraft (embracing the *newer materials for shop teachers and directors of "club" work)*; Machine Shop Practices; Machine and Tool Maintenance; Forging; Gas and Electric Welding; Ornamental Iron Work; Foundry Practices; Air-age Education Seminars for Teachers; Flight Training Courses Leading to Private Pilot's License.

Special Teaching Methods; History of Manual and Industrial Education; Driver Education and Training *(sponsored by the American Automobile Association and the Oregon Motor Vehicle Division.* Includes lectures and laboratory *instruction for the training of high school teachers in the techniques of driver education);* General Shop Problems; Shop Planning and Organization; Construction and Use of Visual Aids; Written and Graphic Teaching Aids; Trade and Occupational Analysis; Guidance and Counseling; Seminars, Special Studies, and Graduate Thesis. Also programs in Education, Science, Home Economics, and general subjects.

The student may plan a program which will lead through successive summers to the bachelor's or master's degree. Approved programs carrying the recommendation of Oregon State College are accepted by all state departments of education for either a *Special* or a *General Secondary* Credential.

*Only a limited number of Industrial Arts courses available in second session.

For Summer Session Bulletin and details:

Address: Director of Summer Sessions, Dept. V

OREGON STATE COLLEGE
CORVALLIS, OREGON

AUTHORIZED BY STATE BOARD OF HIGHER EDUCATION

(Continued from page 68A)

moving parts, except the rubber eraser, are completely covered by a sleeve fully protecting the fingers. The quick-change eraser chuck accepts any of the standard erasers.

Optional equipment includes an easy-to-operate foot speed control permitting freedom of both hands in handling the eraser and an absolute control of speed in *on* and *off* position with the foot.

This eraser is being offered by Chicago Wheel & Mfg. Co., 1101 West Monroe St., Chicago 7, Ill. These erasers are available for immediate delivery.

For brief reference use IAVE—0303.

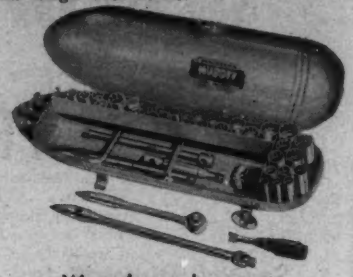
NUGGET WRENCH SET

Blackhawk Nugget Socket Wrenches are now obtainable in the new No. 49K assortment in its new chest.

This red metal chest is bullet-shaped and has wheels and skids for scooting on shop floors. The hinged lid, when open, serves as a receptacle for parts. A scoop-type bottom facilitates easy wrench withdrawal.

The set contains 49 Nugget double-duty drive socket wrenches weighing only 12 lb. 2 oz. Blackhawk claims that 65 wrenches, in the ⅜ and ½-in. drives, would be needed to do comparable work and that such conventional tools would weigh over 19 lb.

The Nugget wrench set with chest closed



Wrench set chest open

The reduction in the required number of wrenches is made possible through the use of Hexite alloy steel which permits a 7/16-in. drive having strength equal to the usual ½-in. drive but the practical compactness of the ¾-in. drive. Measured in dollar savings, Blackhawk says that Nuggets create an approximate reduction of 40 per cent in wrench investment for general work.

For details, write Blackhawk Mfg. Co., Milwaukee 1, Wis.

For brief reference use IAVE—0304.

NEW ELECTRODE WALL CHART

A 25 by 35-in. electrode wall chart, printed in full color, has just been published by The Hobart Brothers Company, Troy, Ohio.

This handy wall chart shows procedures for every type of arc welding electrode; actual results of too long or too short an arc, too much or too little welding heat, too fast or too slow a welding speed, and then shows a perfect bead as well as a cross section of all welds; and complete illustrated welding symbols for both fusion and resistance welding.

A copy of this chart will be mailed free of charge to anyone on request to The Hobart Brothers Company, Troy, Ohio.

Hobart wall chart

For brief reference use IAVE—0305.

NEW GRADY WEDGES

Grady wedges are handy steel gadgets which keep hammer, hatchet, ax, and other tool heads tight on the handle, and are a valuable factor in efficiency and safety. When once driven home, fishhooklike barbs along the sides of each wedge keep them from loosening under vibration or dropping.

(Continued on page 79A)

BRADLEY UNIVERSITY
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DIRECTOR OF THE SUMMER SESSION

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Reduced Tuition Rates for Teachers in Active Service

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FOUR WEEKS — AUGUST 2 to AUGUST 28

TEN WEEKS — JUNE 21 to AUGUST 28

Students will find numerous offerings in the Graduate School, in the College of Letters, Arts, and Sciences, in the Colleges of Architecture, Commerce and Business Administration, Engineering, Music, and Pharmacy; in the Schools of Education, Journalism, Library Science, Public Administration, Religion, and Social Work, and in the departments of Occupational Therapy, Physical Therapy, Radio, and Cinema.

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LOS ANGELES 7, CALIFORNIA

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Division of Vocational and Practical Arts Education

SUMMER PROGRAM—1948

June 28—August 6

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Western Michigan College of Education

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THE PENNSYLVANIA STATE COLLEGE

Department of

INDUSTRIAL EDUCATION

1948 Summer Session June 28 — August 7

Vocational Industrial and Industrial Arts Education

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For further information and catalog address:

Director of Summer Sessions

Room 105, Burrowes Building

THE PENNSYLVANIA STATE COLLEGE

State College, Pennsylvania

DIRECTORY OF MANUFACTURERS' PRODUCTS

This directory is published as a convenient guide to sources of supply, covering the products of manufacturers carrying product information in this ANNUAL NUMBER. For alphabetical index of manufacturers' advertising see page 83A. To obtain products not included in this directory, quotations or additional information to help you make up your specifications, lists of equipment, etc., address Industrial-Arts Service Division, or use coupon on page 83A.

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Behr-Manning Corp.
Carborundum Co., The

ADJUSTABLE CURVE RULERS
Dietzgen Co., Eugene
Engineering Sales Company
Post Company, Frederick

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Aluminum Co. of America

AMMETERS
General Electric Co.
Weston Electric Instrument Corp.

ANVILS
Atlas Press Co.
Cincinnati Tool Co.

ANVIL TOOLS
Stanley Tools

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ARC-WELDING SETS & EQUIP.
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AWLS, TINNERS
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Johnson Gas Appliance Co.

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BAND SAWS
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Boice Crane Company
Brodhead-Garrett Co.
Delta Mfg. Co.
De Walt Products Corp.
Disston & Sons, Inc., Henry
Lewis Machine Tool Co.
Oblen Bishop Mfg. Co.
Oliver Machinery Co.
Parks Woodworking Mach. Co.
Porter-Cable Machine Co.
Walker-Turner Co., Inc.
Wallace & Co., J. D.

BAND SAWS, METALCUTTING
Starrett Co., L. S.

BAND SAWS, PORTABLE
Boice Crane Company
Delta Mfg. Co.
Oliver Machinery Co.
Walker-Turner Co., Inc.
Wallace & Co., J. D.

BAND SAW SETS
Atkins & Co., E. C.

BATTERY CHARGERS
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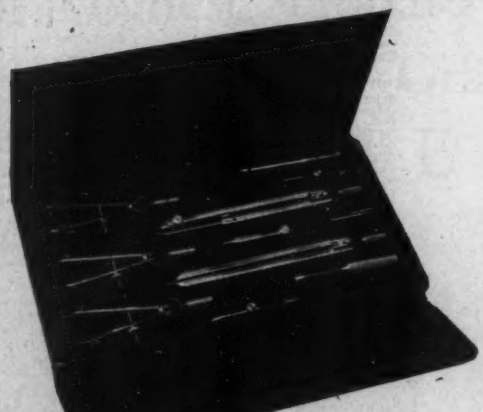

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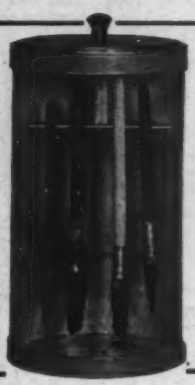

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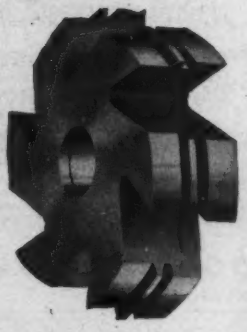

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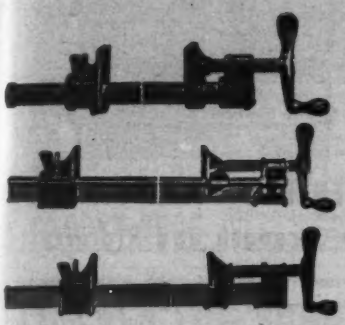

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Our "PONY" Clamp Fixtures (to make clamps on a piece of pipe) have revolutionized the bar-clamp field by their numerous advantages. As usual, there are attempts made to produce something else "just as good" and with the usual results.

You can get the heavier and more powerful clamps in either the flat-bar or "I"-bar types, with the same principles of speed, security and economy built into them as have made the "PONY" Clamps famous. These are the genuine "JORGENSEN" Steel Bar Clamps. They cost no more than others. Write for free Catalog No. 17. Specify "JORGENSEN" or "PONY" on your orders, and see that you get the genuine to avoid disappointment.

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Special Offer for Agents
Blue print 27 x 36" now printed on both sides showing squares full size. Shows how to find the length of any rafter, find any angle, in degrees, frame any polygon three to sixteen sides, read the board foot and brace-table, octagon scale, rafter tables, many other uses, can be scaled down for model work as well as full scale framing. Also chart changing pitches to degrees. For use with radial saws. About 13 square feet of printed copy sent post paid for $1.00.

SLIDE CALCULATOR for Rafters

Makes figuring rafters a cinch! Shows the length of any rafter having a run of from 2 to 23 feet; longer lengths are found by doubling. Covers 17 different pitches. Shows lengths of hips and valleys, commons, jacks, and gives the cuts for each pitch, also the angle in degrees and minutes. Fastest method known, eliminates chance of error, so simple anyone who can read numbers can use it. *Not a slide rule but* a Slide Calculator designed especially for Carpenters, Contractors and Architects. Thousands in use. Price $2.90 postpaid. Check or M. O., no stamps.
MASON ENGINEERING SERVICE, 2106 N. Burdick St., Dept. 3, Kalamazoo 81, Mich.

(Continued from page 70A)

Grady wedges

These wedges will not chip or break under the heaviest hammer blows and every one of them is plated to resist rust and to give an appealing appearance. They are obtainable in seven sizes, and each one is stamped with the words "Red Devil Grady Patented." They are manufactured by the Red Devil Tools, Irvington, N. J.

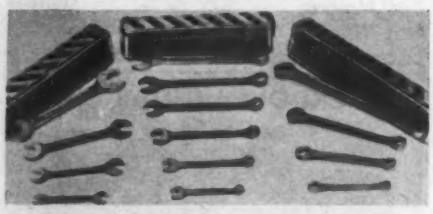
For brief reference use IAVE—0306.

MAXIMUM-USE END WRENCH SETS

Three basic end wrench sets, providing the most-used opening sizes, have been announced by the Plomb Tool Company, Los Angeles 54, Calif. Because popular sizes only were included, the sets offer maximum utility for a low investment, according to the manufacturer. They are said to be good basic sets to which a purchaser may add more sizes in the future.

Set No. 3000BA includes four open end wrenches, with openings (in inches) of ¼ and 5/16, ⅜ and 7/16, ½ and 9/16, and ⅝ and ¾. All of these eight opening sizes are different.

Set No. 1100BA includes four box wrenches,



New end wrench set

with 12-point box openings (in inches) of 5/16 and ⅜, 7/16 and ½, ½ and 9/16, and ⅝ and ¾. Seven different opening sizes are provided in this set.

Set No. 1200BA includes six combination box

(Continued on page 80A)

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(Continued from page 79A)

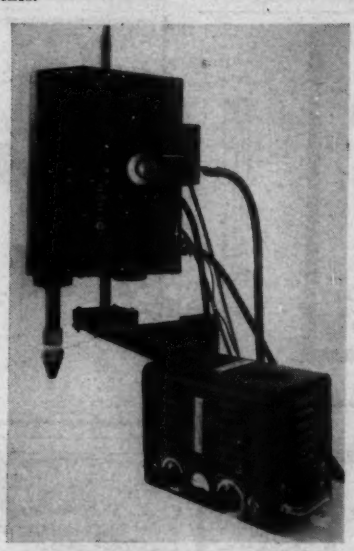
and open end wrenches, with openings (in inches) of 5/16, 3/8, 7/16, 1/2, 9/16 and 5/8. Each combination wrench has both an open end and a 12-point box opening of the same size.

For brief reference use IAVE—0307.

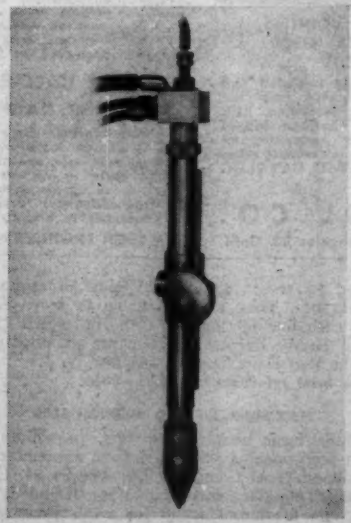
NEW HELIWELDING UNITS

To meet the demand for equipment suitable for the high-speed welding of the light metals such as stainless steel, aluminum, and magnesium the Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y., has announced that it is marketing two new Heliwelding units; a machine type electrode holder and an automatic unit.

The Heliweld machine holder was designed for mounting on a Radiagraph or other suitable travel mechanism for moving along the joint or for fixed position use with the work moving beneath the arc. It has the same barrel and rack as standard 1 3/8-in. diameter machine gas cutting torches.



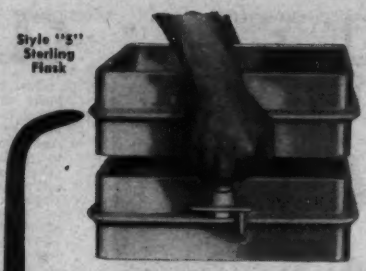
Heliweld machine holder



Airco automatic Heliweld unit

The Airco automatic Heliweld unit, designed for continuous operation, consists of a holder, holder carriage, and a control box. It is fully automatic and electronically controlled. The outstanding feature of this equipment is that it

Style "S" Sterling Flask



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automatically maintains constant arc length. By compensating for setup irregularities it thereby assures a continuous weld of consistent dimensions and quality.

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The machine holder may be used with either a.c. or d.c. welding current while the automatic unit, because of the nature of its electronic circuits, operates on d.c. only.

The Heliweld holders supplied with both types of equipment are virtually identical. The holder is water-cooled, features a durable all-plastic exterior, and is completely insulated for maximum protection. It weighs 28 ounces and is approximately 10 in. long.

For further information write Department 1316, Air Reduction Sales Company, 60 East 42nd Street, New York 17, N. Y., or the Airco sales office nearest you.

For brief reference use IAVE—0308.

GOLD-LEAFING KIT

To enable the beginner to learn the fascinating and valuable craft of gold and metal leaf gilding, the Prodex Company, 509 Fifth Ave., New York 16, N. Y., has introduced a Metal-Leaf-Craft Kit, a gilder's gold-leafing outfit designed to meet the need for this valuable craft in the vocational education and homecraft field.

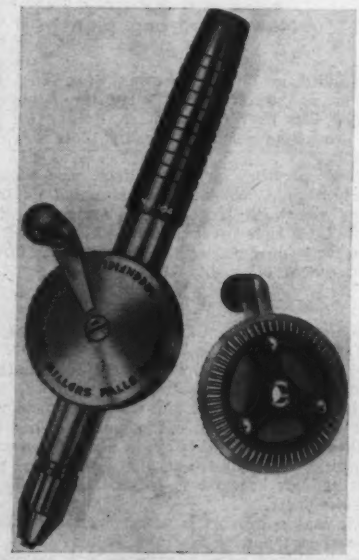
The kit contains the essential gilder's brushes and fluid and an ample supply of Italian gold-colored leaves, together with instructional material to make possible the immediate learning and application of the gilder's craft, to gold-leafing frames, mirrors, art pieces, glass work, and many other projects outlined.

For brief reference use IAVE—0309.

NEW STREAMLINED HAND DRILL

The new Millers Falls No. 104 Hand Drill is strikingly different in appearance and construction from other hand drills.

Outstanding features of this drill include a spindle with "Oilite" bearings and ball thrust; smooth gray enameled aluminum die-cast frame and gear cover; and hollow, screw-cap handle to hold drill points and twist drills.



New Millers Falls hand drill

The hand drill is 12½ in. long, weighs 1½ lb., has ¼-in. chuck capacity, and comes complete with 8 drill points from 1/16 to 11/64 in. in diameter.

(Continued on next page)

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(Continued from previous page)

For further information, address the Millers Falls Co., Greenfield, Mass.
For brief reference use IAVE—0310.

NEW OHM'S LAW CALCULATOR

This new pocket size computing scale published by Ohmite Mfg. Co., 4993 Flournoy St., Chicago 44, Ill., is a new and improved version of the Ohm's Calculator previously published by them.

It expedites calculations that involve ohms, watts, volts, and amperes, as any Ohm's law problem can be solved with one setting of the slide.

The calculator also contains the Resistor Color Code. Its cost is only 25 cents.
For brief reference use IAVE—0311.

SMULLEN JOINS CASEIN CO.

George C. Smullen has joined the staff of the Casein Company of America, Division of the Borden Company, 350 Madison Ave., New York 17, N. Y. Mr. Smullen comes to the Casein Company of America in connection with their expansion activities in casein and casein products. He was formerly with Benjamin Moore & Co., Sherwin-Williams Co., and for the past ten years served as assistant to the president of the Muralo Co., Inc. During the war Mr. Smullen headed the paint, varnish, and lacquer unit of the War Production board.

THE NEW ARMSTRONG PLANT

The new general offices and works of Armstrong Bros. Tool Co., are situated in the Elston-Central Industrial District at 5200–5300 W. Armstrong Ave., Chicago 30, Ill.

New Armstrong plant

Founded in 1890, Armstrong Bros. Tool Co., has grown steadily until today the Armstrong catalog lists over 6500 different tool items and the firm's reputation for quality tools is world-wide.

Now operating in this modern, new plant — Monitor type, one-story construction in light gray brick with stone trim — Armstrong Bros. Tool Co., have over 170,000 square feet of manufacturing space devoted to the further development of quality tools.

J. A. ST. CLAIR DIES

John Alonzo St. Clair of E. C. Atkins and Co., died in Anderson, Ind., May 15, 1947, following an illness of approximately five months.

Mr. St. Clair. was born December 23, 1882, in Boone County, Ind., but for the past 48 years had made his home in Indianapolis. He had been with the Atkins Company in several important capacities since 1901, and the past several years was actively engaged as industrial and mill saw sales engineer.

He was a capable inventor, having developed several methods of saw and knife grinding. He also developed many patents on saw tools, saws, and knives, and other products.

During the recent war Mr. St. Clair was given national recognition in the form of the Achievement Award for his contribution to improved war production in several fields of ordnance.

Survivors are his widow, three brothers, and two sisters.

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31	Aetna Plywood & Veneer Co.	77A
32	Air Reduction Sales Co.	4A
33	Aluminum Company of America	25A
34	American Gas Furnace	82A
35	American Handicrafts Co.	81A
36	American Hardwood Company	82A
37	American Technical Society	24A
38	American Type Founders Sales Corp.	21A
39	Ammco Tools, Inc.	37A
310	Armstrong Bros. Tool Co.	40A
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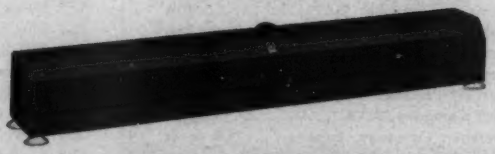

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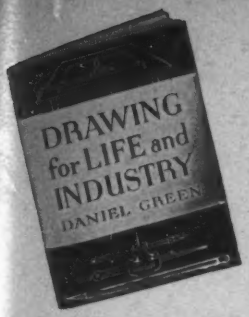

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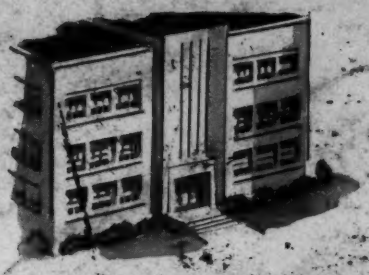

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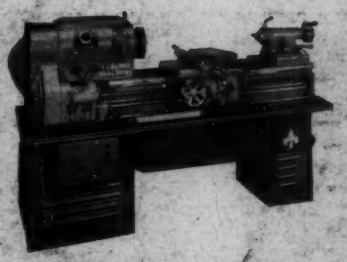

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